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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.)

FIRST PART.
ORIGINAL ARTICLES

Dairying in Uruguay

by

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In Uruguay, milk is produced on farms of varying area, either as a part of the ordinary farm routine with dairy cattle, or by more specialised methods the practice of which is confined to certain regions, particularly near markets. Owing to the local methods of production employed, it is difficult to determine the milk yield in Uruguay. It might, however, be ascertained approximately from the number of dairy cattle existing in the country.

Pending the publication of the "Censo Agropecuario" (Zootechanical and Agricultural Census) which is now being prepared, the only available information is that of the "Censo General de la Republica", for 1908 and which is summarised in Table I.

TABLE I. — *Number of dairy cattle in the various departments of Uruguay.*

Artigas	21,738	Paysandu	14
Canelones	30,342	Rio Negro	14,678
Cerro Largo	20,684	Rivera	20,782
Colonia	12,876	Rocha	11,000
Durazno	20,486	Salto	12,414
Flores	10,126	San Jose	27,279
Florida	30,110	Soriano	16,260
Maldonado	21,880	Tacarembó	14,314
Minas	38,586	Treinta y Tres	14,112
Montevideo	13,675	Total	63,784

According to the above mentioned General Census of 1908 the number is made up as follows :

Pure bred cattle	10 775
Cross bred cattle	289 103
Native cattle	205 585
Not classified	60 501
Total	565 854

In reality there is a larger number of pure-bred dairy cattle, but animals improved by crossing, as will be shown by the Agricultural Census now being carried out.

MILK CONSUMPTION IN RELATION TO THE POPULATION.—The Agricultural department of the "Inspección Nacional de Ganadería y Agricultura" (Inspectorate of National Stock Breeding and Agriculture) has conducted an inquiry on this subject by means of question-papers sent to the "Intendencias Municipales" (Municipalities) of 19 departments, and obtained for the years 1914 and 1915 data regarding the chief town-places of importance, but not the rural districts, for which it is impossible to calculate the amount of milk consumed with accuracy. These are given in Table II.

According to data furnished by the municipal Laboratory ("Oficina Municipal de Análisis") of Montevideo, the average daily consumption of milk in that town is 130,000 l. (228,874 pints), sold by 172 "tambos" (dairies), 105 "despachos de leche" (milk-shops) and 733 "repuestos de leche" (localities for the distribution of milk).

For other parts of Uruguay, the figures giving the daily consumption of milk are only approximate, and the difference between summer and winter consumption has been taken into account as much as possible. This difference, which varies according to locality, fluctuates between 10 to 40 % and is due to a larger yield in summer than in winter and to the corresponding variation in prices, which are higher in winter than in summer.

The data given by Rio Negro and Soriano are calculated approximately by their population and by the milk consumption of neighbouring departments.

The average price of a pint of milk in the different departments of Uruguay is given in Table III.

At Montevideo the price of milk varies between 0.05 and 0.12 (1.42 and 3.4 d. per pint); the average price may be considered as *peso* (2.37 d.).

BUTTER AND CHEESE MAKING.—For the present this branch is limited to the native demand. Besides the establishments which specialise in this industry, it is also carried on in a great number of "estancias pecuarias" (mixed farms) where milch cows are kept. These "estancias" make a certain quantity of butter and cheese, partly for home use and partly for selling at wholesale prices to the retailers. In these farms, but-

TABLE II. — *Milk consumption in relation to the population.*

Departments	Localities	Prots.	Population	
		consumed per day	Depart- ments	Localities
Artigas	San Eugenio	2 112	20 321	10 000
Canelones	Guadalupe	3 520	87 804	4 000
	Las Piedras	1 408		3 500
	Santa Lucia	1 760		3 500
	Pando	1 384		6 000
	San Ramon	880		1 000
Colonia	Colonia	3 108	51 614	8 000
	Nueva Palmira	908		3 500
	Carmelo	3 036		1 500
	Rosario	1 760		3 500
	La Paz	2 1		1 000
	Nueva Helvecia	103		3 500
	Conchillos	1 0		2 000
Cerro Largo	Melo	1 400	14 712	12 500
	Artigas	352		1 500
Durazno	Durazno	8 625	12 325	13 000
Flores	Trinidad	4 100	16 082	8 300
Florida	Florida	6 601	43 100	10 000
Maldonado	Maldonado	2 640	28 870	3 500
	San Carlos	1 32		4 000
	Aiguá	352		2 000
	Pan de Azúcar	1 348		2 500
Minas	Minas	1 760	51 222	13 500
	Battle y Ordoñez	140		4 000
	Zapicán	170		1 000
	Solis	204		2 000
Paysandú	Paysandú	8 800	38 421	20 000
Rio Negro	Frías Bentos	3 168	19 932	7 300
Rivera	Rivera	3 520	35 683	9 000
	Tranquera	352		-
Saccha	Rocha	5 280	34 110	12 200
	Castillos	704		1 200
	Lascano	1 031		2 000
Salto	Salto	16 720	19 250	20 000
San José	San José	6 160	19 321	13 000
	Rodríguez	-		-
	Ituzingó	704		-
	Libertad	210		-
Senano	Mercedes	6 688	19 595	15 000
Tacurembó	San Fructuoso	2 816	19 939	7 516
	Santa Isabel	1 760		-
	San Gregorio	1 050		-
Trenta y Tres	Trenta y Tres	1 100	28 777	7 500

TABLE III. *Wholesale price of milk for consumption in the different departments of Uruguay.*

Departments	Prices per litre in pesos (1)			Prices per pint in pesos		
	Summer	Average	Winter	Summer	Average	Winter
Artigas	0.04	—	0.10 to 0.12	1.14	—	2.85
Canelones	0.05 to 0.07	—	0.07 to 0.09	1.12-2	—	2.85
Cerro Largo	—	0.08	—	—	2.37	—
Colonia	0.04 to 0.06	—	0.06 to 0.10	1.14-1.71	—	1.71
Durazno	0.05	—	0.06	1.42	—	4
Florida	0.05	—	0.06	1.42	—	1.42
Florida	—	0.05	—	—	1.42	—
Maldonado	0.04	—	0.05	1.14	—	1.42
Minas	0.04	—	0.08	1.14	—	2
Payсандú	0.06	—	0.08	1.71	—	—
Rio Negro	—	0.08	—	—	2.37	—
Rivera	0.05	0.12	0.20	1.71	3.41	5
Rocha	0.04	—	0.06	1.14	—	1.42
Salto	0.05	—	0.09	2.00	—	2.37
San José	—	0.06	—	—	1.71	—
Soriano	—	0.08	—	—	2.37	—
Tacuarembó	0.06	—	0.12	1.71	—	—
Treinta y Tres	0.05	0.10	0.15	1.42	2.85	4.2

(1) 1 gold peso of Uruguay = 18.3¢ at par.

is carried on as well as dairying. Some farms have specialized in the breeding and improvement of dairy-cattle, their chief business being milk production.

In the department of Colonia the milk industry is more extensively developed, there being many places with foreign settlers (e. g., SW) where flourishing dairy-farms have been established, amongst which some important "lecherías" and "cremerías".

The most important places for cheese-making are the departments of Maldonado, Colonia, Tacuarembó and Rocha. The establishments whose chief enterprise is the sale of milk, and who only make small amounts of butter, are mostly in the district round about Montevideo, in consequence of the important market provided by this capital. This region includes several localities situated in the department of Canelones, San José and in the southern part of the department of Rivera. The departments of Soriano and Paysandú may also be added to this category.

As it is at present impossible to give in exact figures the data relative to butter and cheese making in the whole of Uruguay, owing to the manner in which its dairy industry is conducted, we will merely quote the department of Colonia as the most important example from this point of view. The following figures relating to the department of Colonia are taken from the detailed information given by the "Intendente Municipal" (Mayor):

Milk-dairies	10
Milk-dairies + butter-dairies + cheese-dairies	10
Total number of dairies in the department	10

Approximate quantities of milk used daily for

Cheese-making	42,186 pints
Butter making	27,176
Total	69,362 pints

IMPORTATION OF THE PRINCIPAL DAIRY PRODUCTS. The favourable conditions for the production of milk and other dairy products in Uruguay, the fact that owing to its numerous improved and even pure-bred cows it is essentially a breeding country, make it possible to foresee that more extensive breeding and growth of forage crops will result in a larger production of milk, and a consequent increase in the amount of cream and cheese available for exportation to the markets of America and Europe. As yet, however, Uruguay is obliged to import these dairy products, as is shown by Tables IV and V.

The amount imported is relatively small, and as Prof. DEMOLLE says in his book "*Lecheria y Cremeria*": "The importation of condensed milk is inadvisable in a completely new country, as it forms a substitute for fresh milk. For this reason, we believe that the descending curve of importation will correspond to the ascending curve of native milk production. We should soon reach the day when condensed milk will solely be used on ships sailing on the water ways in the interior of the country, and then, only when it is impossible to obtain fresh milk."

As is shown by the figures in Table IV, the amount of butter imported is not large.

On the other hand, the amount of cream imported from Argentina is constant, and reaches a value of over 40,000 pesos (£ 850). Since 1910, however, the importation of cream has much decreased. In many years the importation did not correspond to the real demand, but resulted in the possibility of obtaining the cream at a low price during the period of high production in the neighbouring Country, thus allowing it to compete with the native product. The Customs law in Uruguay allows the need of the native product and has established protective entrance duties which will be considered later.

Cheese forms the largest import amongst dairy-products; but it must be remembered that cheese is sold in various kinds and forms and in va-

TABLE IV. — *Importation of the principal dairy products in 1906-1910 (yearly average) and in 1911.*

	1906-1910			1911	
	Quantities in Cwt.	Value in pesos	Value in £	Quantities in Cwt.	Value in pesos
Condensed milk	231	11 333	2 408	192½	5 852
Butter	362	11 594	2 463	120	3 991
Cream	8 879	54 128	11 503	6 939	43 301
Cheese	15 345	319 604	67 940	5 243	109 205

TABLE V. — *Importation of condensed milk in 1911*

Country of origin	Quantities in Cwt.	Value in pesos	Value in £
Argentina	5½	1 730	
Belgium	14	418	
Germany	5½	1 721	
Netherlands	29	878	
Spain	8	230	
United Kingdom	28	860	
Totals	191	5 852	12½

rious categories, with special characteristics according to the country of origin. The cheeses imported are generally those selling at high price. The cheeses manufactured in the country are sufficient for a large part of the demand and are being continually improved. Some good types produced in the departments of Colonia and Maldonado, and it is probable that the Uruguay cheeses will one day be exported in appreciable quantities. In 1914, 252 cwt of cheese was exported, representing a value of 3844 pesos (= £ 824).

The imports for 1911 are given in Table VI, and the figures represent the custom dues exacted for the importation of dairy products are given in Table VII.

To complete the preceding data as to the price of milk in the different departments of Uruguay, we would add that :

The actual price of *new cheese* per kg. varies between 0.23 and 0.4 (£ ½ d to 9 ½ d per lb) according to category.

cream is valued at 0.70 *peso* per kg. of fatty matter (10 d per lb)
butyr is sold wholesale at 0.75 *peso* per kg. (18 d per lb).

LEGISLATIVE MEASURES. -- In all the departments municipal regulations exist for the sale of milk, and which control amongst other points the following:

- 1) Purity of the milk.
- 2) Prohibition of the sale of skimmed or watered milk.
- 3) Regulation of carriage.
- 4) Condition of vessels.
- 5) Hygienic conditions of sale. -- Localities. Vessels, etc.
- 6) Registers of milk-vendors deposited in the Municipal Laboratory.
- 7) Inspection of "lecherías", "tambos", and "despachos".
- 8) Penalties.
- 9) Additional penalties.

The "tambos" are subject to the regulations concerning disinfection and the cleanliness of the cattle, established by the Law on the Inspection of Cattle. The "Sección Tambos y Lecherías de la Policía de Policía Sanitaria Animal" (Dairy Section of the Office of Cattle and Dairy Police) is responsible for the application of these regulations, in accordance with the corresponding regulations which deal with the various questions concerning the hygiene of the dairy business:

- 1) Dimensions and hygienic construction of stables; imperviousness of building materials and conditions of drainage.
- 2) Removal of manure and the state of the dung-hill.
- 3) Hay barns.
- 4) Cleanliness of workmen (prohibiting the employment of persons infected with contagious diseases, or having wounds of an infectious nature on the hands).
- 5) Notification of disease or of the appearance of symptoms indicating same, especially udder troubles. Notification of cases of death among cows, in order that a veterinary examination may be made and suitable measures applied.
- 6) Measures to be applied in the case of infectious diseases (closing the establishment, which will only be re-opened when the "Oficina de Policía Sanitaria" is satisfied that all danger is passed). Disinfection of stables and application of the measures enforced by the Police in the case of sanitation.
- 7) Cleanliness etc. of cows' food (water and forage), of milking and of preservation of milk.
- 8) Penalties.

Similar Regulations are applicable to all establishments where milk and its products are sold and made; as, for instance, forbidding the sale of colostrum and of milk that is stringy, spoilt, bitter, sour, soiled, or of milk originating either from unhealthy cows, or from cows fed on bad or harmful foods, or such as to communicate a bad taste or foul smell.

TABLE VI. — *Importation of cheese in 1911.*

Countries of origin	Quantities in Cwt.	Value in pesos	Value in dollars
Argentina	12	250	12.50
Belgium	106	2,220	111.00
Chile	4	80	4.00
France	151	3,141	157.05
Germany	511	10,614	530.70
Italy	5,875	80,715	4,035.75
Netherlands	333	6,942	347.10
Portugal	7	135	6.75
Spain	148	3,080	154.00
United Kingdom	94	1,957	97.85
United States	1	23	1.15
Totals	5,242	109,205	5,411.00

TABLE VII. — *Custom duties on dairy products imported into Uruguay.*

Products	Estimated value		Duty per cent of estimated value	Duty in pesos per unit of weight	
	pesos per kg.	pence per lb.		pesos per kg.	pence per lb.
1) Condensed milk (including tin).	0.68	15	51 %	—	—
2) Cream *	—	—	—	—	—
3) Butter *	—	—	—	—	—
4) Cheeses (including case)	0.41	10	—	0.38	9
5) Milk sugar	0.50	12	48 %	—	—

* The law of June 1, 1913, has provided for butter, and for the cream intended for making, the following custom duties per unit of weight:

A. — *Butter of all kinds and origins* 0.60 peso per kg. (15 d. per lb.) gross weight.

B. — *Cream:* duty on the *net weight*, up to 50 degrees of fat content per kg., a maximum duty 0.15 peso (3 $\frac{1}{2}$ d. per lb.); *maximum* duty 0.10 peso (2 d. per lb.). If it has more than 50 degrees of fat content, the duty paid is proportional to each degree of fat. The *maximum* duty is exacted when the creameries of the Country are able to do the quantity of cream of native production. If, on the contrary, the Executive Authority is convinced that there is an appreciable scarcity of native cream, then the *maximum* is exacted.

C. — *Butter substitutes* (declared innocuous to health) pay a custom duty of 0.20 per kg. (28 d. per lb.).

the milk; or finally from cows treated with toxic substances whose action is general.

Milk, butter, cheese and other dairy products must come from establishments subject to sanitary control.

Other regulations concern: the standards to which the milk, cream and cheese sold must conform; the hygienic condition of milk and its products; for instance, it is forbidden to introduce the milk from one establishment into another without a permit declaring that it originates from cows that have been given the tuberculin test by the official veterinary station.

The tuberculin test is subject to a special regulation of which the first article is as follows:

"All milch animals (cows, asses, goats etc.) belonging to "tambores", "lecherias", or to private persons who keep the milk for their own use, must be inspected and undergo the tuberculin test by the "Inspeccion de policia sanitaria animal" which will give a sanitary certificate or show in the way it judges best, that these operations have been carried out".

"The tuberculin test will be applied to all potent males, and other kinds of animals susceptible to the disease, "kept by establishments, or persons owning dairy cattle".

"The owners who do not apply these regulations are liable to a fine of 10 pesos (£ 2, s. 2) or to an equivalent imprisonment; the penalty will be doubled in the case of a second offence".

"In case of resistance from the proprietors the tuberculin test will be carried out forcibly, without prejudice to the aforesaid penalties. To this end, the officials of the Sanitary Police, aided by the Public Police, after having, if necessary, forced an entrance into the property of the resisting owner, will take possession of the animals, giving the proprietor proper receipt for them, will perform the tuberculin test, and then return them to the owner".

COOPERATIVE MOVEMENT. Cooperative societies as yet do not play an appreciable part in regard to milk production, or the sale of dairy products; up to the present, one society alone has been formed, which we mention as an experiment in this line of cooperation. Speaking generally the cooperative movement has only recently begun in Uruguay but it is favourably received, the many advantages of cooperation being fully realized.

In concluding, we express the hope that the dairy industry in our Country will give a new impulse to the cooperative movement.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT
OF
AGRICULTURE
IN
DIFFERENT
COUNTRIES.

458 - **Agriculture in India.** — MACKENNA JAMES, *Agriculture in India*, 106 pp. Calcutta.

This work consists of XVI Chapters, the contents of which may be summarised as follows :

I. — *Historical.* — The annual value of the agricultural produce of British India has recently been estimated at roughly £ 1 000 000 000. More than $\frac{2}{3}$ of the inhabitants are engaged in agriculture or in the industries subsidiary to it. In spite of the importance of agriculture to the national economy of India, there was no Department of Agriculture founded until 1880. In 1878, the terrible famines decided the British Government to send a Commission to India to study the best measures to be taken for the improvement of agricultural conditions. On the advice of the Famine Commissioners, there was formed, in 1880, a Department of Agriculture under the guidance of Sir Edward Buck, (now Delegate of India to the International Institute of Agriculture, Rome). In the first place, it was necessary to : 1) organise the survey ; 2) compile statistics of production ; 3) institute enquiries as to the local agricultural conditions in the different districts of India. The data thus obtained and supplemented by the isolated and interrupted work of some scientific workers appointed by one or other of the Provinces, or working on their own initiative with the view of assisting some special branch of agriculture, laid a solid foundation for the systematic studies and researches afterwards undertaken by the Staff of the Agricultural Department. In 1901, an Inspector General of Agriculture was appointed, and a staff of scientific workers recruited. For the latter, there were provided at Pusa, in the district of Bihar, an agricultural research institute, an experimental farm, and an agricultural college. No regular course of instruction is given at the Institute, but the

one who has completed his general agricultural education can specialise in one branch under the personal supervision of an expert. In the annual statement of 1905-1906, it was announced that the Imperial budget would allot the sum of 20 lakhs (subsequently raised to 24 lakhs) to the improvement of agriculture. Colleges were accordingly reorganised, and, at Poona, Cawnpore, Sahib, Nagpur, Lyallpur and Coimbatore. To these Agricultural Colleges were attached provincial Research Stations and Experimental Farms. At the present time, 20 agricultural chemists, 8 economic botanists, 3 agricultural engineers, 1 entomologist and 1 mycologist are employed at these provincial establishments.

II. *Organisation and Work of Provincial Departments of Agriculture.*—In each of the 6 provinces, agricultural and veterinary work is under the control of a Director of Agriculture. In the provinces where there are agricultural colleges, the scientific officers are stationed at the college, and have their laboratories, herbaria, etc. there. Attached to each college is a farm used for training students in practical agriculture, where the improvement and selection of cultivated plants, manurial experiments etc., are carried out. The results obtained are brought before the notice of the native agriculturists by the Demonstration Farms, and, at the seed farms, the improved seed is grown for distribution to the native farmers.

Deputy Directors, aided by a staff of Indian Assistants, control the experimental, demonstration and seed farms. This method of working has been greatly improved many of the chief crops grown in India.

III. *Crops:* 1) *Cotton.* The area under cotton has increased more than 57 per cent in the course of the last 20 years, and at the present time, exceeds over 6 per cent of the total cultivated area of India proper. The main crop of 1913-1914 was estimated at over 5 million bales. Of this, nearly 3 million bales, worth more than 27 million pounds sterling, are exported. In Madras, during the last 20 years, the area under cotton has increased by a million acres; in Bombay, by nearly 1.5 million acres; in the Punjab, by 900,000 acres; in the Central Provinces and Belcher, by 1.5 million acres, while the native states show an increase of nearly 1 million acres. In Bombay, the United Provinces and the Central Provinces, attempts have been made from the earliest days, but with little success, to introduce foreign varieties of cotton. Subsequently the Indian cottons of India were surveyed by the Imperial Cotton specialist, and by the data obtained, the provincial officers proceeded to isolate and maintain pure types, to improve quality by selection, and introduce the improved plant into general cultivation. By this means, varieties of higher yield and larger lint percentage were obtained in the Provinces of Bombay and Madras, in the Central Provinces, and the United Provinces. At the same time, an attempt was made to introduce exotic varieties, especially into districts where they had not been cultivated before; Egyptian and Upland American cottons have been introduced into India. American varieties have been established in Bombay, the Punjab

and the United Provinces, and 1 type of "Upland Georgian" in the Central Provinces, but the greatest achievement has been the introduction of "Upland Georgia" into the Presidency of Madras. Experiments in the improvement of agricultural practice, in cultivation, crop rotation and on manures, are being carried out on experimental farms, and the results, when proved, are being introduced into general practice.

2) *Wheat*. About 10 per cent of the total cultivated area of India is under wheat, and about 15 per cent of the total area of cultivation in the native States. In the last 5 years there has been an all round increase of about 8 $\frac{3}{4}$ million acres, while in 1915, there was a further increase of 6 million acres. As it was found that all the varieties of wheat grown in India were peculiarly liable to rust, many attempts were made to introduce Australian, English and North American wheats, but without success, because these varieties mature too late, and the growing season of wheat is relatively short in India.

Lately, Mr and Mrs Howard have selected at Pusa, 25 types of Indian wheats which are distinguished for their high yield. They are now trying to obtain, from these types by selection, and by crossing with foreign varieties, wheats with standing power, rust resistance and high gluten content (the latter being required by the British market). Satisfactory results have already been obtained and as it has also been found that these varieties of wheat do well in other parts of India, it has been proposed to increase the amount sown on a large number of the Punjab seed farms, in order to distribute the selected seed throughout the wheat growing districts of the country.

3) *Rice*. This cereal is predominant in the Eastern Provinces and Burma. The area under rice exceeds 80 million acres, which represents 35 per cent of the total cultivated area of India. In Assam, nearly 80 per cent of the cultivated area is under rice, in Burma, 74 per cent, and in Bengal, 70 per cent. The varieties of paddy are numerous, and this makes selection and the improvement of methods of cultivation a very difficult task. Nevertheless, the efforts already made have been successful from the points of view of yield and nutritive value. At the present time the work of selection is chiefly based on the shape, colour, uniformity and consistency of the grain. The work is being carried out upon irrigated and non-irrigated rice varieties; spacing and manurial experiments are also being conducted in all provinces. The general experience seems to be in favour of green manuring for transplanted paddy; bonemeal is, however, in many provinces, reported to give good results. Other experiments have been made as to the dates of ploughing and sowing, the amount of seed to be used and the number of young plants to be planted out. The control of insect pests and fungus disease has also been begun, but it is rendered difficult by the vast size of the tracts affected.

4) *Sugar cane*. As a result of foreign competition, there has been a considerable diminution of the area under this crop during the last few years, notably in Bengal, Bombay and the Central Provinces, but as a rule, there have been large increases in Madras, the United Provinces

The total area under sugarcane in 1913-14 was 2,510,800 acres; the United Provinces contributed 1,370,000 acres and the Punjab

In Southern India, varieties with thick, fine canes and high sugar content are grown, which do not do well in Northern India. In Southern India irrigation is much more intensive, heavy dressings of manure being used though the quality is good, the crop is unimportant and the area under sugarcane is very small. A parasitic disease known as "red rot" causes injury every year to the sugar plantations. It is therefore necessary to obtain by selection and crossing, richer canes giving higher yields; and greater resistance to disease, and yet adapted to the methods of the native cultivator. Such is the work on which Dr Barber has been engaged at his own research station at Coimbatore; the Experiment Station of the United Provinces, Bihar and Assam have also been occupied with the same problem, and considerable results have already been obtained in this direction. Further, much has already been done in improving the sugar-making machines, and in devising a machine that will be suited for sugar making on a small scale by small cultivators, or groups of cultivators.

Jute.—India is the only country which produces this plant on a large scale, and its cultivation is limited practically to Bengal and Assam. Area under jute has averaged, in recent years, about 3 million acres; in the last 10 years, the number of jute mills in Calcutta has increased from 10 to 60. Extensive trials have shown that the successful cultivation of jute is quite possible over a wide area outside the jute-growing districts that in Burma, Assam and North Bikan, the area is capable of a vast extension. The selection of some of the cultivated types, which has been carried out since 1906, the year in which Finlay began his study of the jute raised in India, has furnished some pure lines possessing high yield, strength and durability. Some of these pure lines have been raised and seed is now available for distribution. It is hoped that it will be possible to improve these varieties still further by the help of hybridization. Manurial experiments at Bardwan and elsewhere have shown that in addition to cow-dung, oil cake and green manures (*Urtica Cathartica*) can be profitably applied.

Other fibrous plants.—Flax, Sunn hemp and *Hebeura cuneata* (Bombay hemp) occupy about 8,00,000 acres. These plants have not been improved by selection. Some entomological and mycological studies regarding the Coconut palm, which is cultivated on the West Coast of Madras and in the maritime tracts of Lower Burma, have resulted in practical advantage.

Indigo.—Twenty years ago, the area under indigo was well over 100,000 and a quarter acres; it is now only 1,17,000 acres and is steadily decreasing. With a view to rehabilitating the industry the Java indigo plant was introduced in 1898, but in 1907 it was attacked by some unknown insect which killed the plant before the seed set, so that for some time it was impossible to improve the qualities of the plant by selection and crossing. Howard, however, discovered later that it was not a question of a

disease properly so-called, but that the wilting of the plants was due to the long-continued wetness of the soil, and to the bad cultural methods employed by the natives, who always remove all the leaves from the plants once. Proper aeration of the soil is essential, and a full supply of water to the roots, and especially to the nodules of the roots, is necessary for the production of a crop of good indigo plants seed for selective purposes.

As selection based upon *indican* content is too difficult and slow a process; those plants which grow more rapidly and robustly and have more leaves than the bulk of the crop, are grown apart, in order to select a type producing a high *indican* content. To improve the cultivation, it is recommended to harrow back after the removal of the cover crop, instead of cutting back, and to remove the crop after the flowering. By these methods, it is hoped that it may be possible to restore indigo cultivation to its former flourishing condition.

8) *Tobacco*.—Several promising varieties have been isolated, and it still remains to fix their qualities by hybridisation; the methods of cultivation have also been improved.

9) *Oleaginous plants*.—A certain amount of selective work has already been done on rape and sesame; the latter crop covers some 100,000 acres like a million acres in Burma. The ground nut was introduced into India in 1902, and has expanded with much rapidity, now being largely grown in the arid zone of the country and in the United Provinces.

10) *Tea*.—This plant was introduced into India about 1837. The tea industry has, generally speaking, prospered from that date, while between 1886 and 1910 the area under tea only increased by 98 per cent, the production in the same period increased by 260 per cent; this was due to the scientific workers employed by the Indian Tea Association and the United Planters' Association of southern India.

11) *Coffee*.—Coffee-growing dates from the beginning of the 19th century; the industry is practically confined to the Madras Presidencies, Mysore, Coorg, the Wynad, the Nilgiri, Pulney and Shevaroy Hills. Coffee does not enjoy the same prosperity as tea, for it encounters very keen competition from Brazilian coffee.

12) *Rubber plants*.—Rubber is a crop which is coming into prominence, especially in Burma and Madras. The exports in 1911/12 were valued at over half a million sterling.

13) *Fruit-growing*.—This industry has not been neglected and has been done, especially at Quetta and Peshawar, to improve the varieties cultivated, and to introduce better methods of fruit packing and export.

IV. *Silk*.—The silk industry is comparatively insignificant, and is likely to decrease on account of the competition of other countries, especially Japan. Nevertheless, an attempt has been made to increase the production by the introduction of better methods of rearing the silkworms and the improvement of the loom used in silk manufacture.

V. — *Irrigation and Drainage*.—Considerable progress has

and late in these directions, especially in Madras, Bombay, the United Provinces and the Punjab.

VI. *Scientific Research.* - Much work has been done in the various branches of agricultural science, especially at the Central Research Station at Pusa but also at the Provincial Stations.

1) *Chemistry*: The use of phosphatic manures on Indian soils; the properties of alkaline soils; the water requirements of some Indian crops; the fixation and movement of nitrates in the soil; the chemical composition of sugar-cane, sugar-beet, milk, date-palm sugar; the composition and nutritive value of Soy beans, rice etc, etc.

2) *Mycology*: Preliminary survey of the important fungus diseases of Indian crops; methods of controlling plant diseases.

3) *Entomology*: Collection and study of the habits and life histories of Indian insects. Methods of controlling the insect pests of plants and animals.

4) *Agricultural Bacteriology*: Bacterial activity in the soil (the soil bacteria affecting the supply and utilisation of combined nitrogen; the fixation in, and elimination from the soil of plant toxins); the study of animal plant diseases; the action of bacteria in milk.

VII. - *Agricultural Education.* Agriculture, as such, is no longer taught in the primary and secondary schools, for it is now agreed that education must be general, and that it is necessary to develop the powers of observation; this, however, does not prevent the use of text books dealing with familiar objects connected with agriculture.

In the secondary schools, great importance is attached to knowledge of English, to nature study, and practical instruction in the rudiments of history and botany, in order to enable the pupils to profit by the courses in the Agricultural Colleges. The Government of India no longer insists on a "standard" curriculum in the latter, but leaves the Province free to frame its own scheme of agricultural education with reference to the stage of general educational development and agricultural research that may be reached. Lately, a native agricultural school has been started in Bombay. This school takes boys from 14 to 16, the course is thoroughly practical and lasts 2 years, while general education is continued, together with special instruction in agriculture.

VIII. *Veterinary Matters and Cattle.* - The Civil Veterinary Department in India was constituted in 1889; it consisted principally of the military veterinary officers of the horse-breeding establishment. Since 1901 the staff has been recruited from veterinary colleges in England. The official organisation consists of superintendents, who are members of the Civil Veterinary Department; deputy superintendents; inspectors, veterinary assistants. There are now 400 assistants, 15 inspectors, 19 deputy superintendents. There are veterinary colleges at Bombay, Calcutta and Madras, and a veterinary school at Rampoor. The training is of a thoroughly practical type and the results are very gratifying. Continuous research work is concentrated at the Imperial Bacteriological Laboratory at Muktesar and a branch laboratory has been opened

at Bercilly. The chief work consists in preparing vaccines and especially anti-rinderpest serum.

Cattle-breeding.—In accordance with the views expressed at the last meeting of the Board of Agriculture, the production of the "improposed animal" (one combining draught and milk) should be attained by crossing native cattle with the best European breeds. In many co-operative cattle insurance societies have lately been started.

Mr MACKENNA'S report deals with the ten years period 1900-1909. In the last chapter, he refers those persons who are desirous of obtaining complete and detailed information regarding agriculture in the Empire, to the publications of the Imperial Department. These can be obtained from Messrs Thacker, Spink and Co. Calcutta, and are:—"*Agricultural Journal of India*",—"Proceedings of the Board of Agriculture in India",—"Report and Memoirs of the Agricultural Research Institute, Pusa".

Mr Mackenna estimates that the increase in the value of the natural products of India, as a result of the labours of its Agricultural Department is already over £ 2,300,000. The last decade has also seen the growth of the co-operative credit movement—that great factor in the progress of economic development.

The writer concludes his report by reminding his readers that the motto of the Department of Agriculture should be: "Sympathy and Education".

489. **Notes on the Period preceding Oviposition in the Domestic Fly.** (R. H. Snodgrass, Department of Agriculture, Bulletin No. 315, pp. 13. Washington, D.C. February 5, 1910.)

During recent years, the destruction of house flies (*Musca domestica*) especially in the spring, has been regarded as the means of reducing future generations. The apparent justification for this method of control was based on published records of experiments and observations indicating a rather long period of time between the emergence of the adult fly and the first deposition of eggs, (the so-called "pre-oviposition" period). The scientific data from which this theory is deduced are founded on a somewhat meagre scientific basis; some experiments on this subject were carried out at Arlington Va (1913) and at New Orleans La. (1914); collaborators made other experiments. Flies kept in cages were used; the results obtained led to the following conclusions:

The shortest record for the period preceding oviposition was 2 1/2 days; the usual length was from 4 to 5 days.

Temperature has a very decided influence on the length of the period; thus at 28° F. (12° C.) the period was shortest and at 18° F. (7° C.) was longest.

Other factors influencing this period are: humidity; the kind and quantity of the food of the adults; the kind and quality of the larval food; its resulting effect on the size and physiological condition of the adult.

In the experiments with isolated pairs of flies, very few results were obtained, only 7 out of 30 laying a few eggs, which suggests that these

that a number of females in the process of egg laying is the normal habit and that isolation has an inhibiting effect.

Copulation was observed as early as the 1st. day after emergence and late as the 47th. day. No copulation was noted when the temperature of the air was below 55° F (12.7° C).

The maximum record for longevity was 70 days and the minimum 1 day or less. The average length of life for some 3,000 flies was slightly over 10 days.

CROPS AND CULTIVATION.

The Effect of Phosphoric Acid Upon the Decomposition of Sugar in the Soil.

BIKKE, S. in *Készlet és Közlemények Communications of the Hungarian Agricultural Station* Vol. XVIII, Paris 6-6, pp. 857-884. XXII Plates. Summary in German on pp. 885-886, Budapest, 1915.

The decomposition of the sugar present in the soil as shown by the liberation of carbonic acid, is influenced by the chemical composition of the soil and by the presence of certain salts which are suitable for plant food. Thus, in a soil to which phosphoric acid has been added, the sugar breaks down more quickly (i. e. more carbonic acid is liberated for a certain time), than in the same soil without the addition of phosphoric acid. If the amount of carbonic acid liberated daily from the first and the second soil is estimated, it will be found that the difference between these amounts increases for a certain time, and then decreases.

According to these experiments there seems to be a certain correlation between the effect of the phosphoric acid on the decomposition of the sugar (liberation of CO_2) and the larger yield which it produces in manured experiments. Thus, in a soil where the addition of 0.06 (gr.) of P_2O_5 per kg. had raised the yield of oats and mustard, the same amount of P_2O_5 had increased the amount of CO_2 given off in the presence of sugar (5 per cent dextrose or saccharose). It was found that the more the phosphoric acid had increased the yield of these plants, the larger also was the difference between the respective totals of the CO_2 liberated. Increasing quantities of P_2O_5 gradually increased the liberation of CO_2 and therefore effected a very regular increase in the difference of the above mentioned values.

The energy of the liberation of CO_2 is affected by numerous factors which modify the action of the phosphoric acid. Thus, the presence of carbonate of lime (CaCO_3) promotes the decomposition of the sugar.

Sulphate of ammonia (NH_4SO_4) at the rate of 0.05 gr. of nitrogen (N) per kg. of soil, has also a favourable effect, which however is influenced by the nature of the soil. Small quantities of nitric nitrogen, (0.05 gr. N, in a form of nitrate of sodium (NaNO_3) per kg. of soil) also increases the liberation of CO_2 in the presence of sugar, however, in a nutritive solution, 1% of NaNO_3 exercises an inhibiting effect. Sulphate of potassium

(K_2SO_4) also increases the liberation of CO_2 in certain soils, while it decreases them in others.

In short, the above-mentioned effect of phosphoric acid is chiefly influenced by the addition of nitrogenous and of potassic compounds according to the nature of the soil. As a rule, any quantitative addition in one of these nutritive substances modifies the action of the other.

1911. — **The Value of *Saccharum spontaneum* in Binding Moving Sands Sicily.** BONAI A., in *Bollettino di Studi ed Informazioni del R. Giardin. bot. Palermo*, Vol. II, Part 1, pp. 189-213, 6 figs., Palermo, 1910.

The chief object of this article is to draw the attention of the public to certain species of Gramineae which experience has shown to be useful in the improvement of the condition of the sands of the coast in some parts of Sicily; this is done by listing the characteristics of the plants from cultural and biological stand-points, and showing how they may be more widely used.

Amongst these Gramineae, the first place for utility in binding together the sands of the southern districts belongs to *Saccharum spontaneum* L. (= *Saccharum aegyptium* Wild.) which perhaps represents the original wild form of the sugar cane. On the north coast, and at some places on the east and south coasts of Sicily, *S. spontaneum* is often found, usually cultivated, but sometimes having reverted to a wild state. It provides a shelter for the fields and kitchen gardens against the sea winds. Its culture dates back several centuries, especially in the country round Messina, where the plant was probably introduced from Egypt. *S. spontaneum* is a perennial growing throughout the year; its stems attain a height of 4.2 m. or with its leaves, of over 9.84 ft., while in garden soil its roots are never no longer than 11.7 in., but in loose sandy soil they can attain a depth of 6.56 - 9.84 ft. In garden soil, the radius of the rhizomes never exceeds 11.7 in. in one year, but in sand they can grow to a length of 8.2 ft. and occupy an area of 23.829 sq. yds. and more; this plant, therefore, spreads considerably over the sands.

Owing to the combined effects of the torrents and the sea, the north coast of Sicily is continually extending, so that in periods varying from 10 to 20 years, according to the locality, a strip of an average width of 8 m. requires reclaiming. After marking out the area to be reclaimed *S. spontaneum* is planted in lines perpendicular to the direction of the prevailing winds. The planting is effected in the cool season (from Autumn till May) by means of pieces of cane from 13.65 in. to 15.6 in. in length, with 20 nodes. The small canes are planted 11.7 m. deep and from 7.8 in. to 11.7 in. apart, in squares. The sand driven by the wind is held up by the plants which quickly take root and grow rapidly. A dyke is thus made that attains its full height (as much as 4.92 ft.) in from 3 to 4 years, and becomes an efficient and permanent protection for the land behind it, which is then devoted to vine-growing.

In order to make this protection more certain and to permanently prevent the surface of the dyke being disturbed by the winds on the anterior slope, plantations are made of *Opuntia amygdalae* and *Agave americana*.

the landward slope. This is often unnecessary, as the surface becomes covered naturally by different wild plants, the most common being *Cyperus rotundus*, *Panicum repens*, *Dactyloctenium aegyptiacum*, *Ambrosia artemisiifolia*, *Medicago marina*, *Lobos cytisoides*, *Eryngium maritimum*, *Paronychia arguta*, etc. Of these plants, *C. rotundus* is the one which is most good for binding the soil together.

Cover Crops for Porto Rico. — KIRKMAN, C. L. *Journal of the Department of Agriculture, Bulletin No. 10*, 32 pp., 8 plates, Washington, January 27, 1910.

The term "cover" crop is used to designate a crop to be grown on land devoted to horticulture in order to get rid of wild vegetation, to prevent surface washing, to shade and enrich the soil, and to improve its chemical condition.

The land devoted to horticultural crops in Porto Rico is very deficient in humus and greatly damaged by surface washing. Since during the past years, cover cropping was practically unknown in Porto Rico and was introduced after the American occupation of the island. There is a great difference in soil types and local weather conditions in Porto Rico which makes the selection of a cover crop giving satisfactory results a matter of great importance. The work of testing and sowing plants for cover crops has been carried on for a number of years by the Porto Rico Agricultural Station. Most of the testing and cultural work has been conducted by the Station itself at Mayaguez. The most suitable plants (together with a number of others which appear to be less promising) have been cultivated elsewhere on the island, in cooperation with plantation owners.

The writer discusses the habits of the cultivated plants; he recommends cover crops for Porto Rico; namely:

Cowpea * (*Vigna catjang*, or *V. sinensis*); Jack Bean (*Canavalia ensiformis*); * Sword Bean * (*C. gladiata*); * Lyon Bean (*Stizolobium niveum*); * Bengal or Mauritius Bean (*Stizolobium aterrimum*); *S. cinereum* (Latinum); * Florida Velvet Bean * (*S. deringianum*); * Pigeon Pea * (*Cajanus indicus*). Of the wild plant growing in Porto Rico which are worthy of protection and of cultivation in orchards, the writer describes the following:

Mani cimarrona * (*Chamaecrista diphylla*); Matuca (*Crotalaria retusa*); Zarzabacoa galana, (*Desmodium adscendens*); * Zarzabacoa común (*Desmodium incanum*); * Habichuela cimarrona * (*Phaseolus adenanthus*); * Yerba rosario * (*Aeschynomene americana*); * Conchita poluda " (*Mimosa pubescens*); * Tamarindillo " (*Cassia chamaecrista*); * Habichuela parada " (*Phaseolus semierectus*); * Mato de la Playa " (*Canavalia ucticola*).

Vigna Catjang is grown in all parts of the island, it has the shortest growing period of any of the leguminosae described by the writer, and is valuable as a cover crop and for forage.

Canavalia ensiformis, although recently introduced, is in more general use than any other cover crop. It thrives on all except very light soils, for account of its habit of growth, is very desirable in citrus orchards, *Stizolobium niveum*, *S. aterrimum*, and a number of recently introduced

velvet beans, succeed well on all types of Porto Rico soils where leguminous crops are grown. They are suitable for growing in open fields for general use (forage, green manure, seed) where care is taken to avoid injuries through the rank-growing vines choking out other plants.

Cajanus indicus succeeds well in all parts of the island. It is cultivated as a cover crop and wind-break, and also for its edible seeds. Under favourable conditions, the plants continue their growth for a few weeks.

The thrifty annual leguminosae which are growing wild, are easily killed and should be protected and encouraged. They reseed themselves and are very resistant to drought and heavy rainfall.

The humus in Porto Rico soil devoted to citrus culture disappears when clean cultivation is practised. The soil and climatic conditions favour the use of cover crops throughout the sections where citrus fruits are grown.

In old coconut groves where there is a good "stand" of trees, dense shade prevents a thrifty growth of cover crops. In young groves or where the "stand" of trees is poor, *Stizolobium*, *Canavalia*, *Cassia*, and *Vigna Catjang* are satisfactory cover crops. *Vigna catjang* and *Cajanus indicus* are used both as catch and cover crops in coconut groves.

Cajanus indicus and *Canavalia ensiformis* hinder the growth and production of "Cabezona" and "Red Spanish" varieties of pine apple when planted in the bed with them. *Cajanus indicus* was more harmful than *Canavalia ensiformis*, and the development of the "Cabezona" variety was retarded more than the "Red Spanish".

Cover crops make their heaviest growth and serve their purpose best when planted in spring, or early summer.

Nodule-forming bacteria are present in most Porto Rico soils; if the bacteria are wanting, inoculated soil should be scattered over the soil at the time of seeding the cover crop.

491 - **The Respective Values of Organic and Inorganic Manures.** - Hottelott H. in *The Journal of the Royal Horticultural Society*, Vol. XLII, Part 2, pp. 21-22, London, December 1915.

The writer examines the results of manurial experiments made at Rothamsted showing the superiority of organic nitrogenous and phosphoric manures over inorganic manures, especially in the case of crops like wheat and swedes which remain longer in the soil. He discusses the fact that mechanical, chemical and biological factors account for this superiority of organic manures. Reference is also made to the recent American theory of the sterilising effect of mineral manures. From a consideration of the general effects of both classes of manures he makes the following practical conclusion:

Organic manures are useful to supply humus, which improves the texture and assists cultivation; to give a gradual supply of food to the crop, which promotes healthy growth and good quality; and to provide humus to feed the soil bacteria.

Mineral manures are useful as a top dressing for rapid growth and to act as a steriliser to keep the bacterial flora in balance. They tend to pro-

an unnaturally quick, soft and sappy growth, which should be avoided in the case of permanent crops like fruit, but which is exactly what is required in green crops like cabbage, lettuce, etc., because in addition to giving richness they also produce a tender leaf.

The Reclamation of Bog Land in Ireland (11). *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XXV, No. 1, pp. 125-200. Dublin: January 1916.

Pot experiments on the manurial treatment of unreclaimed bog were started in 1913 and followed by field experiments in 1914. These experiments showed the importance of a complete mixture of artificial manures and lime. Nitrogen was more important than potash, except in the case of grain crops.

During last year raw peat from six different bogs was tested in pots and plot experiments were made on two bogs, one in King's County and the other in County Tyrone.

In the pot experiments, mustard was grown in each case. The following fertilisers were applied in groups of three: nitrogen as nitrate of soda and sulphate of ammonia, superphosphate, kainit, and burnt lime.

In no case did any seedlings grow on the untreated soil, and in only two cases did any growth appear in the pots without lime. With two exceptions, the influence of phosphate was more important than nitrogen and it invariably happened that potash was the least important of the four in all cases. Potash appears to be of less importance in the case of cruciferous crops and others grown for stems and leaves only; but when it comes to the formation of grain or of tubers, the effect of potash is most marked.

The results of the field experiments with the various crops were as follows:

Rape. — On the no-lime plots, the rootlets appeared as if burnt up as soon as the seed germinated, and on the plot without phosphate most of the seedlings died soon after germination. There was considerable growth on the no-nitrogen plot, but the absence of potash appeared to be the least important factor.

Rye. — In the absence of lime or of phosphate, only a few stunted plants without grain were produced. The absence of nitrogen did not show such marked results and the grain was of fair quality. Potash made no difference in the early stages, but when the ears were formed the difference was most marked. In the absence of potash, the grain was shrivelled and the straw soft, as if thrashed.

In the case of a wet bog, the absence of nitrogen from the mixture was marked as the absence of potash.

Potatoes. — All the plants produced tubers, even in the untreated plots where only a few stalks appeared above ground. The absence of phosphate appeared to be more important than the absence of lime. The want of

11. See also B. Dec. 1915, N. 1255

potash was more marked than the want of nitrogen. The plot receiving the complete manure with lime was far superior to any other and yielded 6 $\frac{1}{2}$ tons per acre. Although a large percentage of the tubers were small the yield is very satisfactory considering that growth was checked by a frost on June 19th. On wet bog land, lime appeared to be more important than phosphates and nitrogen than potash.

Pot experiments were carried out to test the value of shell sand and marls in replacing burnt lime. The crop grown was mustard and each plot received the same quantity of nitrogen, phosphate and potash. The following substances were compared: burnt lime, marl, shell sand, peaty marl and gravelly sand.

The quantities used were: burnt lime $\frac{1}{2}$ per cent, marl and shell sand $1\frac{1}{2}$ per cent, gravelly sand 4 $\frac{1}{2}$ per cent.

The marls and shell sand gave quite as good, if not better, results than the lime. They acted as quickly from the very start and effectively corrected the acidity.

495. **The Utilisation of the Nitrogen of Stable Manure in Relation to the Date of its Application.** — SARACENKOW A., in *Selskoe Khozostvo i Lesnovodstvo* (Agriculture and Silviculture), Vol. CCXLIX, pp. 190-512, Petrograd, December 1915.

In attempting to answer the question as to how long stable manure should remain in the soil in order for it to give the maximum amount of nitrogen in an assimilable form, the writer reviews the results of experiments made on this subject both in the laboratory and field by the best known Russian and foreign experimentalists, and describes in detail the results obtained at the Agricultural Stations of South Russia. The critical examination of these numerous data has led the writer to the following conclusions.

1) No complete explanation has, so far, been given of the action of temperature, humidity and aeration upon the biological processes taking place in the manure between its application to the time of sowing and which determine the period during which it is necessary for the manure to remain in the soil, so that the nitrogen may be most fully utilised.

2) The results of the laboratory experiments obtained in different investigations show that the utilisation of the manure increases and the injurious effect of the straw decreases in proportion to the time they remain in the soil.

3) So far, there exist no results, obtained in the field, which give a decisive answer to the question. The results obtained by the Agricultural Stations of South Russia sometimes contradict those obtained in the laboratory, but this contradiction is due to the fact that in this region damp is the *minimum* factor with reference to the other growth factors and therefore plays a much more important part than the latter and masks the effect of the stable manure.

4) It would be better to carry out experiments on this subject in the following manner: to dig the manure into the black fallow (which is cultivated in the autumn) at the following times; autumn-spring (April and May) — summer (June and August) and to divide the land into different

noting the effect of the manure during a certain number of years and its action upon the crops cultivated.

Deducing a conclusion from available data, it would appear that the question as to the complete utilisation of the nitrogen of stable manure in connection with the time of its application, still remains an open one.

20. **"Rhenaniaphosphat", a new Phosphatic Fertiliser Containing Potassium manufactured in Germany.** — REMY TH, Bonn University, in *Deutsche Landwirtschaftliche Jahrbuch*, Year 36, No. 25, pp. 178-179, Berlin, March 18, 1910.

For some weeks, a German Society ("Bezugsvereinigung der deutschen landwirte") has been offering a new phosphatic fertiliser to agriculturalists, which is manufactured at the "Rhenania S. A." factory at Stolberg under the name of "Rhenaniaphosphat" by the process of Dr. Meschede, which has been patented in Germany. Since 1913, the "Institut für Boden und Pflanzenbaukunde" of Bonn University has carried out analytical experiments with this new fertiliser, and has obtained such satisfactory results that the writer recommends it as a substitute for superphosphate or Thomas slag.

From the chemical point of view, the fertiliser is a complicated compound consisting of: silica, phosphate of lime, potassium, sodium and free lime. It contains 12 per cent of phosphoric acid of which 75.95 per cent is soluble in citric acid; from 3.4 per cent of potassium and 25 per cent of lime. The potassium is completely soluble in hydrochloric acid, almost completely soluble in water saturated with carbonic acid, while 25 per cent of it is soluble in pure water. In the manurial experiments, about 75 per cent of the potassium was utilised by the plants.

"Rhenaniaphosphat" has the additional advantages of being easily ground, of not being hygroscopic and of mixing easily with other fertilisers.

Its phosphoric acid, moreover, is as available as that of basic slag, which fertiliser the new compound greatly resembles in its effect, while it is slightly more rapid in its action.

"Rhenaniaphosphat" is particularly suitable as a fertiliser for light, cold soils rich in humus, but it also gives good results in the case of heavy soils under leguminous crops.

21. **Report on Experiments with Bacterised Peat or Humogen.** — G. C. CHITTENDEN, F. J. "Contribution from the Wisley Laboratory, in *The Journal of the Royal Horticultural Society*, Vol. XLII, Part 2, pp. 395-426, London, December 1914.

These experiments were begun in 1914 at the request of the Council of the Royal Horticultural Society.

Nature of the Peat. — The raw material consists of peat moss litter or dried sphagnum with an ash content of only 1.37 per cent. It is brown in colour and acid in reaction, and is generally detrimental to plant growth. The bacterising process consists of three stages: 1) treatment with a culture solution of the special 'humating' bacteria and incubation at a constant temperature for a week or 10 days; during this period solu-

¹ See also *B.*, 1914, Nos. 110-112 and 119-121.

(Ed.)

ble humates are formed; 2) destruction of the humating bacteria by sterilisation with live steam; 3) treatment of sterilised peat with mixed culture of nitrogen fixing organisms — *Azotobacter chroococcum* and *Lythmus radicola* — and incubation at 20° C. for a few days, after which it is ready for use. Prof. Bottomley's theory is that the nitrogen fixing bacteria thrive on the soluble humates formed by the humifying bacteria. His analyses showed that the nitrogen content increases from about 1.2 per cent to 4.31 per cent in the finished product.

Four consignments of peat were used and there was a marked difference in appearance between the different lots.

Object of the Experiments. — The experiments were designed to determine whether the alleged acceleration of growth was due to: 1) the aeration holding capacity of the peat, or 2) the salts and especially the nitrogen contained, or 3) the action of hypothetical accessory food bodies, which might be called activators.

Experiments in 1914. — The first experiments were carried out with loam in pots under glass. The plants chosen were *Primula malacoides*, *Begonia semperflorens*, *Eupatorium adenophorum* and tomato.

Owing to the great individual variation amongst the primulas they were discarded. The Begonia plants were grown in 5 sets of 4 plants of equal size and age, and different quantities of bacterised peat were compared with ordinary loam and a mixture of loam and raw peat. A considerable difference between the plants was seen in a week or 10 days and this difference became more marked as time passed. The plants in the bacterised peat were all of a much deeper green, had larger leaves, became considerably taller and showed a much greater tendency to branch from the base than the control plants, while the leaves of plants in the soil containing raw peat showed a tendency to burn.

Eupatorium adenophorum is particularly suitable for these experiments as it is remarkably uniform in growth and grows quickly at the dull season of the year in an ordinary greenhouse. The luxuriance of growth in the treated peat compost was very marked, the area of the last eight leaves of the plants in the treated peat compost being more than 50 per cent greater than that of the plants in the untreated pots.

Tomato. — Twenty seedling tomatoes were grown in large pots with ordinary loam. Another series of twenty were grown in soil containing bacterised peat and a third series to which ordinary peat was added. The plants in the soil containing the bacterised peat were much more luxuriant and had darker foliage. This luxuriant growth however was not accompanied by a delay in the flowering period as would be expected. In fact flowers first appeared on these plants and were borne little higher up the stem than were those on the plants in ordinary soil. Little difference was noticeable between the plants in the ordinary soil series and those in the soil and raw peat series.

In these experiments no obvious effect on the root development was observed as recorded by other experimenters, but in all the plants there was a copious branching of the plants growing in the bacterised peat. Complete

of the growth of plants in soil and bacterised peat with that in soil and untreated peat shows that the water-retaining power of the peat is sufficient to account for the differences in growth.

Increasing the amounts of the bacterised peat up to one half the contents of the pots caused very slight increase in growth and no detrimental effect, thus supporting the theory of the existence of "activators" in the peat.

Experiments with peat extract. - Tomatoes were grown in sand and peat with the following extracts:

1. water extract of bacterised peat
2. " " of boiled peat
3. " " of untreated peat
4. ammoniacal water extract of untreated peat
5. water alone

In each case 12 plants were used. The extract was given once a week and water as required.

The plants receiving the ammoniacal extract all died within two days. The other plants grew well but those receiving the bacterised peat extract were twice the size of the others. There was practically no difference between the plants watered with either of the other peat extracts and those watered with tap water.

These results show that the value of treated peat lies in the water soluble constituents after bacterisation and that mere heating does not bring about these changes in the peat.

Experiments in the open garden. The soil of these plots is very light but retains sufficient moisture to keep plants growing. Radishes, cabbages and French beans were grown. Three plots were arranged for crops as follows:

- Plot A. bacterised peat at the rate of 2 tons per acre. Harvest in June.
- " B. no peat or other manure.
- " C. untreated peat at same rate as A.

In one series, radishes (French Breakfast) were sown on May 20 and crop removed and weighed on July 9.

No difference was seen in the growth of the plants on the respective plots nor was there any difference in the rate of germination. The average yields of the plants from plots A and B were the same.

On another series of plots "Early White Stone" turnips were sown on May 25.

- Plot A. received no dressing.
- " B. received bacterised peat at the rate of 2 tons per acre.
- " C. as plot B. with an addition of 15 cwt. of ammoniacal sulphate.

These plots were arranged in triplicate. The results were summarised as follows:

Series	Treatment.		
	Nothing.	Bacterised peat.	Bacteri- Manure.
	lbs.	lbs.	lbs.
1	123.5	136	134
2	128	135	115
3	75.5	77.25	9

There appeared to be some hastening of growth in the seedling stage by the use of the bacterised peat. In all cases there was a slight increase in the weight of crop due to the bacterised peat. This increase however was more in the tops than in the roots where the bacterised peat alone was used. The effect of the manganese appeared to be to redress the balance between root and top which was upset by the bacterised peat. *French Beans* were grown on another series of plots and the following results obtained:

TABLE 10. *French Beans*.

	No. of Plants.	Weight of crop gms.
Plot A. untreated peat	691	26.2
" B. no manure	737	26.5
" C. bacterised peat	640	26.5

The average yield for each plant was in all cases small. That from the plot receiving untreated peat was about 3 per cent above the control while that from the plot receiving the bacterised peat was 12 per cent above the control.

Grass. A grass plot 10 ft. by 60 ft. was dressed with bacterised peat at the rate of 3 tons per acre, but no visible effect was observed from the dressing.

These results were much inferior to those obtained in the pot experiments. In order to remove the possibility of the soil moisture being the limiting factor, another series of experiments was arranged in open plots artificially watered.

The soil chosen was poor and had not been recently manured. Six plots were used and turnips were grown under various treatments as follows:

Plot	Treatment	Average weight per plant in lbs.		
		Tops	Roots	Total
1.	Bacterised peat	33	74	97
2.	Bact. peat and farmyard manure	34	67	101
3.	Farmyard manure	34	68	102
4.	" " " and artificials	4	67	107
5.	No manure	28	69	80
6.	Lime	3	66	70
7.	Bact. peat and lime	33	77	103
8.	Bact. peat	29	50	80
9.	No manure	3	6	9
10.	Farmyard manure	20	61	81

In both the watered and unwatered plots farmyard manure gave the best plants, and where bacterised peat was used on the watered plots had a good effect, but not so great as farmyard manure, especially when used by artificials. On the unwatered plots the bacterised peat actually diminished the yield. The peat + lime on the watered plots was about equal to the farmyard manure plots.

The greatest average weight of roots was given by the peat in conjunction with lime: next came the no manure followed by farmyard manure.

There was less difference between the weights of roots than between the total weights, which points to the fact that the greatest difference was in the foliage. Apparently the watering assisted the action of peat as well as that of the farmyard manure.

Experiments in 1915. — Similar experiments were carried out this year with further consignments of bacterised peat, using radishes both under glass and in the open and turnips in the autumn.

The growth of the radishes was retarded by the peat but the turnips grew much more rapidly at first and appeared taller and greener. Considering the weight of the roots produced, the effect of the peat appeared negligible. The failure to obtain a striking increase cannot be attributed to lack of water and the results do not justify the assumption that peat contained 4.3 per cent of nitrogen as previously stated. A dressing of $\frac{1}{2}$ tons per acre, the amount applied in this year's experiments, would be equivalent to the heavy dressing of 5 cwt. of nitrate of soda per acre assuming only half of the nitrogen to be available. These considerations strengthen the belief that the bacterised peat is of very variable composition.

At the present price of £10 per ton the bacterised peat is inferior to farmyard manure, 20 tons of which can be delivered at a cost of £8, producing a greater yield than can be obtained by the application of 1 ton of the

498 - Plants Indigenous to Chile which are Cultivated, Capable of Cultivation, or Used

— REICHERT KARL, in *Boletín de la Sociedad de Fomento Fabril*, year XXXII, Nos. 11, pp. 474-490, 679-684, 776-784, Santiago, July, October and November 1912.

Attention is first drawn to the fact that the introduction into Chile immediately after its discovery, of plants cultivated in Spain, prevented cultivators devoting themselves to the improvement of the native plants which are capable of giving good results when selected and cultivated. A list is given of the most promising plants, each name being followed by a description of the species, its habitat and the manner in which it is used.

The species mentioned are as follows:

I. CEREALS AND OTHER PLANTS WITH EDIBLE SEEDS. — Those grown formerly by the natives — “mango” (*Bromus mango*); “quila” “colihue” (*Chusquea* sp.) — have been completely replaced by maize imported by the Incas, or by European cereals. However “quinua” (*Lupinus* *napodium* *Quinoa*) (1) is still a somewhat important crop.

II. TUBERS AND ROOTS: the best known and most used are the “*llobata*” (“flor de la perdiz”) — *Cumingia campanulata* — *Solanum tuberosum*, and *S. maglia*, of which the tubers are employed — *Alstroemeria* L. (“liuto”) with starch-containing roots.

III. — FIBRE CROPS. The Chilean species of *Linum* are of a low rate of growth; those belonging to the *Urticaceae* have never been used; there are therefore no indigenous textile plants properly so-called. On the other hand, there are quantities of lianes with long, flexible, resistant stems which are used as cords in basket-making and are included under the name “voquis”, such as, for example; *Lardizabala biternata* — *Boquila latifolia* — *Cissus striata* — *Griselinia racemosa* — *Mitraria coccinea* — *Urtica nea ovata* — *Luzuriaga radicans* and *L. erecta* (“quelineja”) — *Marsippermum grandiflorum*. In the salt marshes of the southern part of Chile *Schoenodon chilensis* (“Canutillo”) is grown. From the stems and leaves of *Juncus procerus* and *Cyperus laevis* and from the leaves of *Greigia pectinata*, *Typha angustifolia*, and *Jubaea spectabilis*, mats and baskets are made. Ropes are dressed with the bark of *Aristolelia Macqui*.

IV. — PLANTS USEFUL FOR TANNING. — Chile possesses excellent plants useful for this purpose: *Balsamocarpum brevifolium* (“algarbilla”) which the tannin-containing pods are largely exported — *Persea Linza* *Cryptocarpa Pumilus* — *Euchryphia cordifolia* — (“muermo”) or “*muermo*” both with tanniferous bark — *Gunnera Chilensis*, with tanniferous rhizomes.

V. — PLANTS CONTAINING SAPONIN. — Of these the chief is *Quilaja saponaria* which is found from the Province of Coquimbo to Arica. *Solanum elaeagnifolium* (whose pods contain saponin) is much less important, it is common in the northern provinces, as far as the province of Aconcagua.

VI. — DYE PLANTS. — The pods of the “maqui” impart a beautiful colour to red wines, and are much exported. *Galium Redban* — *Ga-*

(1) See also B. January 1916, No. 59.

chensis — *Cephalophora* sp. *Flaveria contrayerba* were formerly grown, and furnish red, black and yellow dyes respectively.

VII. — PLANTS CONTAINING GUMS AND RESINS. — *Puya coarctata* and *Chusquea* produce Chagual gum; — *Tessaria absinthioides* ("bica vegetal") yields a resinous gum; — *Flourensia thurifera* — *Robinsonia gayana* and *R. thurifera* — *Baccharis rosmarinifolia* — *Larrea acaulis* ("llareta") furnish resins that can be used for various purposes (the second is a substitute for galbanum resin); — the resins of the Chilean conifers (*Fitzroya* — *Agathis* — *Araucaria* etc.) are not yet utilised.

VIII. — MEDICINAL PLANTS. — These are very abundant in the Chilean flora, and many of them are used by the empiric practitioners of the country, but only very few are entered in foreign pharmacopœias; the best are:

Used for their leaves: *Eugenia Chequen* ("chequen") — *Boldoa frutescens* — *Lithraea venenosa* — *Glarionea atacamensis* ("matucel") — *Eriogonum gnaphaloides* ("tè de burro") — *Gnaphalium viracina* ("vitagra") — *Flaveria Contrayerba* — *Eryngium rostratum* ("cancha") — *Faurea imbricata* ("pichi") — *Psoralea glandulosa* ("culen") — *Lathraea venosa* ("latué") — *Quinchamalium majus* and other species ("quinchamal") — *Haplopappus Baylahuen* ("baylahuen") — *Solanum Berteroanum* and *S. tomatillo* ("natri") — *Cassium Parqui* — *Ambrina ambrosioides* — *Artemisia copa* ("copa") — *Senecio crispus* ("chachacoma") — *Rhapis rosea*.

Used for their bark: *Psoralea glandulosa* — *Quillaja saponaria* — *Myrica Winters* ("caneol"). Used for their roots: *Valeriana papilla* ("papilla") — *Aryelia huidobriana* ("trien") — *Anisomeria drastica* ("pirren") — *Calystegia rosea* ("caricillo").

IX. — VARIOUS PLANTS. — Plants for binding dunes: *Distichlis thalassia* — *Panicum urvilleanum* — *Hierochloa utriculata* — *Isotephia nodosa* — *Carex pumila* subsp. *littorea* — *Mesembryanthemum acqui-laterale* — *Ergonum chilense* ("doca") — *Fragaria chilensis* (the two last also supply crops); in the northern region, the sands are bound naturally by *Coldenia bacumensis* and by the low growing shrubs, *Skytanthus acutus* and *Ephedra andina*.

Plants for Quickset Hedges: *Greigia sphacelata* and *Puya coarctata* are used in the northern oases — *Gourliaca decoratus*, low growing and with delaced branches — *Rubus ulmifolius* and *Opuntia vulgaris* are two of the hedge plants imported into and acclimatised in Chile.

Plants furnishing beverages and syrups. After the introduction into Chile of the vine and the wine-making industry, the old custom of making fruit wines was discontinued. Formerly, the fruits of *Aristotelia Macqui* — *Vaccinium chilensis* — *Lithraea molle* ("molle") and *Ugni Molinae* etc. were used, and even a fungus called "llanillo" (*Cyttaria* sp.). However the manufacture of "chicha" from the drupes of the "molle" is still fairly important industry. In the palm groves of Ocoa and Cocahu, a syrup sold under the name of "palm honey" is obtained by the concentration of the sap extracted from a topped trunk of *Jubaea spectabilis*. The

chief honey-producing plant is *Eucryphia cordifolia* ("munero" or "mo"), to which is due the abundance and exquisite flavour of the "viano" honey; it flowers in January and February.

The Chilean kitchen-garden plants are on the whole of little importance for they have been advantageously replaced by imported and acclimatized species. However, the following are grown: the "berro" (*Arenaria nasturtioides*)—the "pangue" (*Gunnera Chilensis*) and the "petela" (*Tetilla hydrocotylifolia*) of which the young petioles ("nalcas") etc., are used. The best native truck plant is *Tetralonia expansa* which grows well on the coastal zone from Coquimbo to Chiloé; it is exported and cultivated abroad, but not made use of in Chile.

EDIBLE CRYPTOGAMS. — The "huilte" and the "cochayuyo" ("hierba del mar"), are used by the people as food, the first comes from the stems, the second from the digitate laminae of a large marine alga, *Durvillaea utilis*, growing between Valparaíso and Cape Horn. The dried laminae of the "luchi" (*Ulva latissima*) are also used as an article of diet. The following fungi are edible: *Agaricus campestris* (found in enormous quantities north of Punta Arenas) — *Pholiota edulis* — *Clavaria coralloides* — a species of *Boletus* etc.

X. — FRUIT-BEARING SPECIES. — Fruit trees: *Araucaria imbricata* ("piñal") of which the seeds are edible — *Podocarpus andina* ("llengue") — *Jubaea spectabilis* ("palma di Chili"), oil is also extracted from its seeds. *Guevina Avellana* ("avellana") — *Boldoa fragans* ("boldo") — *Gomortesia nitida* ("queñe") — *Cryptocarya Peumus* ("peumo") with oleaginous seeds — *Bellota Miersii* ("belloto"); in many parts of the province of Aconcagua where this species is very plentiful, its acorns might be used for fattening pigs — *Persea gratissima*, var. *melanocarpa* ("palta negra"), much cultivated in the valley of Quillota — *Lucuma Valparadisea* ("palta colorado", or "lucuma silvestre") common in the narrow, damp, shady valleys of the provinces of Aconcagua and Valparaíso; at present, the fruit of the wild tree is not eaten, but the species seems capable of improvement by cultivation — *Gourliea decorticans* ("chañar") — *Prosopis siliqua trum*, and other allied species, ("algarrobos") of which the fruit is much prized in N. Chile as a feed for domestic animals.

FRUITING SHRUBS. — *Aristotelia Macqui* ("maqui"); its fruit is eaten raw, or prepared in different ways; "chicha", an alcoholic beverage is made from it, while a colouring matter is extracted from the seeds. *Ugni molinae* ("murtillo"), one of the best native fruits — *Berberis buxifolia*, cake and syrups are made from its fruits — *Pernettya* spp. — *Gaultheria* spp. *Myrteola leucomyrtillus* ("huarapo") — *Ribes magellanicum* ("patrulla") whose bunches of black berries well deserve the attention of horticulturists — *Empetrum rubrum* — *Rubus geoides*, and *R. camaropsis radicans* ("limonmué") — *R. ulmifolius* ("zarzamora") has since become acclimatized in Chile and produces excellent fruit, which however is but little appreciated — *Lardizabala biternata* (of which the fruits are called "cogúiles") — *Margaripapus setosus* ("sabinella") — *Muehlenbeckia chilensis* ("quilo

Sphedra spp. ("pingopingo")—*Krameria risoldica* ("paicu") its leaves are used as a substitute for coffee.

HERBACEOUS FRUIT BEARING PLANTS: *Fragaria chilensis* ("frutilla") is eaten fresh, or dried; "cicha" is made from it. *Greggia sphaecolata* which the fruits are called "chupones"—*Lapageria rosea* ("Copilue") *Mesembryanthemum aequilaterale* ("doca") with edible, slightly laxative fruit. *Cereus* spp., *Eulychnia* spp., and *Psidium pyrifera* of which the somewhat acid fruits all bear the name of "guayaves".

XI—FOREST TREES(I). The most important species furnishing firewood are: in South Chile; *Tepula stipularis* ("tepu") *Eucryphia* sp. the province of Santiago: *Quillaja saponaria* ("quillai") *Lithraea venosa* ("litre") and *L. molle*—*Prosopis siliquastrum* *Acacia cavena* ("esphino")—*Maytenus boaria* ("maiten") Many other species used for firewood and charcoal are only of local importance.

The northern zone of Chile (from the frontier of Peru to Coquimbo) abounds with forest trees: *Prosopis siliquastrum* and *P. tamarugo* ("tamarugo")—*Gourliea decorticans* *Polylepis incana* ("queñoa") *Schinus molle* ("molle" or "pimentero")—*Salix Humboldtiana* ("sauc") *Cordia decandra* ("carbon") etc.

The chief forest trees of the central zone of Chile (from Coquimbo toception and Arancania are: *Quillaja saponaria* *Criptomarya Peumus Bollea Miersii*—*Persca lingue* and *P. Meyeniana* *Acacia cavena* *Arctostaphylos punctatum*—*Lithraea venosa* and *L. molle* *Bollea fragrans* *Winters* ("canelo") *Tricuspidaria dependens* ("patagua") *Maytenus boaria*—*Villarezzia macronata* ("luilli-patagua") further ch. *Gomortega nitida*—*Nothofagus obliqua* ("roble"); *N. Dombeyi* ("sogne"); *N. procera* ("rauli")—*Myrceneugenia apiculata* ("arayan") and *Pitca* ("pitra")—*Myrtus luma*—*Libocedrus chilensis* ("cipres") *Arancaria imbricata* ("arancaria").

The southern zone of Chile is rich in forest, composed, not only of the common trees that it possesses in common with the central zone, but also others that are peculiar to it, such as: *Eucryphia cordifolia* *Laurelia patagonica* ("laurel") and *L. serrata* ("huahuau" or "vauvau") *Nothofagus panulio* and *N. antarctica* ("ñirre") *Edwardsia masnahanana* ("chili") *Maytenus magellanica* ("leña dura") *Tepudalia stipularis* *Remannia trichosperma* ("teñiu")—*Guevina avellana* *Embothrium coccineum* ("notru")—*Libocedrus tetragona* ("cipres del sur") *Patagonia patagonica* ("alerce")—*Saxegothaea conspicua* *Podocarpus chilensis* ("mañiu") etc.

Colonial Plants of Economic Importance Cultivated in the Royal Colonial Gardens of Palermo, and Capable of Acclimatisation in Sicily. — TROIANI G., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. 1, Part 4, pp. 149-150. Vol. 11, Part 1, pp. 36-41; Part 4, pp. 231-234. Palermo, 1913-1916.

The botanical name of each plant is given, followed by information on its economic utility, its characters and appearance, observations upon

See in B. December 1911 pp. 1515-1517. Original Article by Federico Alberti—The Colonies of Chile.

its behaviour in the Colonial Gardens of Palermo, and opinions regarding the possible economic importance of its acclimatisation to Sicily.

Amongst the most important species that have proved capable of growing in the open in the above-mentioned gardens may be mentioned *Ficus elastica* (the rubber obtained from it has been valued at 7 p. per kg. (6 s. per lb.); *F. religiosa*, *F. indica*, *F. Vogelii* — *Manihot* (cassava) — *Achras sapota* — *Aegle sepiaria* — *Agave rigida* var. *sisalana* (sisal) for cultivation in Sicily on 'plains and slopes facing south. — *Annona cherimolia* (already perfectly acclimatised in Calabria) — *Arachis hypogaea* many species of *Bambusaceae* — *Cecropia palmata* — *Cheirostemon pinnatifolius* — *Chloris Gayana* (acclimatised in Sicily; this plant has resisted drought and produced an excellent crop of forage, even without irrigation. — *Colocasia esculenta* — *Cordia Sebestena* — *Diospyros Kaki* — *Mangifera indica* (suffers a little during the winter) — *Persea gratissima* (fruits ripen completely) — *Pilocarpus pinnatifolius* (which, however, produces little pilocarpine) — *Psidium Guayana* — *Saccharum officinarum* (produces a little sugar; it would, however, be best to grow it only for sugar) — *Sapindus Mukorossi* — *Secium edule*. In Sicily, the latter remains in a herbaceous condition, it only ripens in the autumn; it bears about a hundred fruits per plant (hence its name of "Zucca centenaria", by which it is commonly known in the island). Its young tops are used as a vegetable, while its fruits (when cooked) and its root tubers (after a 2nd year) are also used for human consumption. The writer draws attention to the importance that this plant possesses for Sicily when the conditions are favourable to its cultivation.

500. The Distribution of the Genus *Lotus* in European Russia and the Caucasus. GROMOV J., in *Trudy Burau po prikladnoi botanike* (Bulletin of Applied Botany), 8 VIII, pp. 1025-1057. Petrograd, September 1915.

A systematic review of the species and varieties of the genus *Lotus* in European Russia and the Caucasus, together with maps of the distribution of each variety. Much use is made of the literature referring to the subject and given in a bibliography at the end of the article.

The genus *Lotus*, which does not occur in America, is found all over the eastern hemisphere, reaching 71° N. latitude. On the west coast of Africa it is found at 10° on the east coast, at latitude 30° south and throughout the south east of Asia, it appears in Australia.

Nearly all the species are especially common on the sea coast, whether the latter be sandy, argillaceous, rocky or grassy, dry or marshy. Some species of *Lotus* grow equally well on low plains, and on high ground, when they can be found at an altitude of 415 metres.

Of the 60 species of *Lotus*, distributed for the most part in the Mediterranean region, only 7 occur in Russia, and these belong almost exclusively to the *Antholotus* section; 3 of these species, *Lotus Gebelii* — *L. longicarpus* — and *L. strictus* are only found in districts of the Caucasus. *Antholotopodiceides* grows, not only in the Caucasus, but also on the southern part of southern Russia in Europe; while *L. uliginosus* occurs only on the western portion, *L. angustissimus* in the south-eastern part of Russia in Europe.

L. denticulatus, in many different forms, is the only species that occurs throughout the whole of Russia.

The Inoculation of the Chief Leguminosae with Six Different Species of Nodule-forming Bacteria. Experiments Carried Out in Kentucky. U. S. A. — GARMAN H. and LUDTKE MARY in *Kentucky Agricultural Experiment Station Bulletin* No. 184, 1914, 303 + 7 Plates, Lexington, Ky. August 1914.

A report on experiments in inoculating the most commonly cultivated leguminosae with different species of nodule-forming bacteria. The writers used some thousands of plants, growing them for the most part on solutions of agar in test tubes and bottles; they carefully sterilised both the native solution and the receptacles, taking all possible precautions to avoid contamination. The following are the results of the experiments.

The statement that the organism causing nodules on the roots of Lucerne (*Medicago sativa*) is the same as that producing nodules on *Melilotus* has been proved to be wholly correct. Cultures of the organism from nodules on the roots of lucerne cause nodules on the roots of *Melilotus* as well as on those of the lucerne itself, and *vice-versa*. Further, this bacterium has proved itself to be identical with that producing nodules on other related species viz: *Medicago lupulina* and *Medicago denticulata*. Therefore, cultures of the bacteria from these 4 different species of plant can be used equally well for the inoculation of one any of them. But these bacteria do not produce nodules on the roots of any species of *Trifolium*, *Pisum* — *Vigna* — *Glycine* — *Phaseolus*.

All the species of *Trifolium* are affected by a single species causing the nodules. The culture will produce nodules on the roots of any other member of the genus, no matter from what species of *Trifolium* the organism is obtained; it will not do so in the case of plants of the genera; *Medicago* — *Melilotus* — *Pisum* — *Vicia* — *Vigna* — *Phaseolus* — *Glycine*.

The microorganism producing nodules on the vetch and garden pea, appears to be distinct in physiological character from the two preceding cultures from the nodules of *Vicia villosa* do not produce nodules on clover; lucerne; *Vigna Catjang*, soya beans and common beans; nor do the organisms from these nodules give rise to nodules on *Vicia hirsuta*, they can, however, be transferred to the roots of *Vicia sativa*; in the same way, cultures of bacteria from pea nodules produce nodules on *Vicia sativa*. Cultures of the bacteria from the nodules of the spring vetch and the garden pea show similarity when examined under the microscope, which supports the belief that the micro-organisms are identical.

Nodules could not be produced on the roots of any other species of leguminosae by means of cultures from the nodules of *Vigna Catjang*, nor on the cow-pea by inoculating the roots of the latter with cultures taken from the nodules of any other leguminosae. It therefore seems that the bacteria giving rise to nodules on *Vigna Catjang* must constitute distinct species.

The same result having been obtained with the bacteria from the nodules of the soy bean and the garden bean, these two micro-organisms must be regarded as two distinct species of nodule bacteria.

The chief conclusions drawn from these results are as follows: the bac-

teria producing nodules on the roots of the commonly grown leguminous plants are of different species, differing from one another in their physiological behaviour. A given species of bacterium may be confined to a single species of Leguminosae, or be common to several species of this family, and these several species may not be members of one genus, though they commonly are.

An organism which does not naturally produce nodules on a certain plant, cannot be induced to adapt itself to this new host. Thus, the bacteria after being cultivated for a year on a medium made from an infusion of the roots of soy bean, would not produce nodules on the soy bean at the end of this time while still producing them abundantly on their host plant, the vetch.

In the earlier experiments, little difference was found in the plants in favour of the inoculated lots; in fact, the controls frequently started rather better than the treated individuals, but the plants with good nodules persisted longer, and showed more vigour in resisting decay, often retaining their leaves longer than the controls.

Details are given of a somewhat large number of inoculation experiments.

392 - **The Presence of Copper in Tomatoes and Tomato Preserves.** — LIBERIO CARMANO A., MARSIGLIA T., ZAY C., in *Annali della R. Stazione chimico-agricola sperimentale di Roma, Series II, Vol. VIII*, pp. 163-393, Rome, 1916.

This paper is divided into 2 parts:

I. *Historical*, consisting of the following chapters: 1) Copper in plant and animal organisms — 2) The physiological action of copper: *a)* on plant organisms; *b)* on animal organisms — 3) copper from the legal standpoint — 4) Review of the methods for determining small amounts of copper in animal and plant substances.

II. *Experimental*, consisting of the following chapters: 1) Method followed for estimating copper — 2) Experiments on tomatoes in the experimental field of the Station of Agricultural Chemistry in Rome — 3) Presence of Copper in tomatoes grown in Italy, in preserves made of these tomatoes and on land devoted to this crop. — 4) Conclusions.

The electrolytic method was employed for estimating the copper, and as it was always a question of very small quantities, the weighing of the copper was followed by a colorimetric test.

In the Grottarossa experimental station belonging to the Station of Agricultural Chemistry of Rome, tomatoes are grown with a view to ascertaining whether it is possible to detect and estimate in the different parts of the plant and fruit, the copper derived, either from the normal quantity present in the soil, or from sprayings with Bordeaux mixture. The following tables give some of the principal results obtained.

TABLE I. — *Composition of the Tomato Fruit.*

A. — *Approximate Composition.*

	In 100 parts of fruit		
	fresh	dry at 110° C.	ash
the juice and pulp correspond to . . .	95.75 "	79.07	98.00 "
the seeds " " . . .	0.70	12.30	3.15
the skins " " . . .	0.35	7.97	1.55

B. — *Composition of the various parts of the fruits.*

	Water and volatile matter at 110° C. (by difference)	Non volatile residue at 110° C.	Ash
Juice	95.04 "	4.09 "	0.00 "
Pulp	80.04	10.39	1.02
Seeds dried at 110° C.		100.00	3.15
Skins dried at 110° C.		100.00	2.11

TABLE II. — *Copper contained in the different parts of the tomato fruit and in the soil (in mg.)*

	Copper in 1 kg. of juice and pulp			Copper in 1 kg. of seeds		Copper in 1 kg. of skins		Copper in 1 kg. of dry soil
	Fresh	Dried at 110° C.	Ash	Dried at 110° C.	Ash	Dried at 110° C.	Ash	
lime-sulphur mixture	0.25	5.04	37.99	10.45	336.03	7.01	364.52	7.20
spraying of plants	0.35	7.09	53.48	9.87	317.23	8.86	408.48	7.19
laying of soil	0.46	9.27	69.90	11.72	376.85	12.46	574.20	16.20

TABLE III. — *Distribution of 100 parts of copper in the different parts of the tomato fruit.*

Treatment	In the pulp and juice	In the seeds	In the skins
No-spraying	67.67 "	21.04 "	10.69 "
spraying of plants	71.68	16.09	12.64
spraying of soil	75.17	14.73	10.10

TABLE IV. — *Distribution of the copper in the different parts of the tomato plant *, mg. of copper per kilogram of matter dried at 110° C.*

Stems	8.44 mg	Clusters	6.42 mg
Leaves	6.45 "	Whole fruits	7.43 "
Soil	7.83 "	Soil	7.37 "

* The plants had been sprayed twice with lime-sulphur mixture.

TABLE V. — *Copper contained in the different kinds of preserves of tomatoes from the experimental field (in mg.)*

Treatment	In 1 kg. of unconcentrated juice and pulp	In 1 kg. of preserve where the juice and pulp were reduced to				
		40%	25%	20%	15%	10%
No spraying	0.25	0.63	1.00	1.25	1.67	2.50
1.5 sprayings of plants	0.35	0.88	1.40	1.75	2.33	3.50
1 spraying of soil	0.46	1.15	1.84	2.30	3.07	4.60

In the various centres of tomato growing, and especially in the most important ones, 84 samples of the fruits were taken, each accompanied by a sample of the soil on which the fruit had been grown, and by all the data relating to it. It was especially important to know whether the plants had been treated with copper, and if so, how often.

The copper was estimated: 1) in the juice and pulp of washed tomatoes; 2) in the soil that had produced each sample of tomatoes; 3) often also in the residue (seeds and skins), and in the water used for washing. The results are given in numerous tables. Further, the importance of tomato cultivation is dealt with and of the preserve industry in the case of each region of Italy, while statistical data, lists of factories, etc., are given.

Conclusions. — The examination of numerous samples of tomatoes, and of soil taken, either from the writer's experimental ground, or from different districts of Italy, proved that:

1) In the fruits of the tomato, copper is constantly found, without any exception, in quantities varying from 0.14 mg. to 2.10 mg. per kg. of juice and pulp, and from 3.88 mg. to 19.45 mg. per kg. of dry residue.

2) All the soils upon which the tomatoes investigated had been grown contained copper up to 110.74 mg. per kg. of dry soil.

3) Spraying the plants with cupric mixtures has no effect upon the copper content of the tomato fruits.

Thus, the presence in the preserves of small quantities of copper is perfectly justified. It must certainly be attributed to the constant presence of this metal in the soil, whence the plant assimilated it in different proportions according to the varying absorbent property shown by soils in respect of copper compounds, and their power of retaining the latter in insoluble forms, or in those assimilated by plants with difficulty.

In the appendix, a bibliography is given of 165 publications.

503 — *The Part Played by Mineral Elements in Plant Life.* — EGOROV M. A. (*In Russ. Opitnoj Agonomii* (Review of Experimental Agriculture), Vol. XVI, Part 4, pp. 270-277, Petrograd, 1915).

Maturation in *Gramineae* shows in the gradual assumption of yellow colour, while plants which for some reason or other cannot ripen and form seed, retain their ordinary green colour. In this connection, the

is yet known as regards the part played by the mineral elements in the death of plants.

In attempting to explain this process, the hypotheses of different writers as to the causes of the death of plants are reviewed. The fact established by BATALINE is quoted, that when after the rye harvest, rain is followed by a long period of drought, the rye plants can become perennial, and a working hypothesis is suggested.

As the seeds develop, a considerable part of the substance of the plant including the mineral elements, becomes concentrated in the seeds. An element which accumulates in the largest quantities, with the exception of phosphorus and sulphur, is magnesium (up to 50 per cent).

Now, since according to WILLSTÄTTER, magnesium alone of all the mineral elements of the plant is present in the chlorophyll, it is thus concluded that the migration and fixation of this element in the seeds must cause the disintegration of a considerable part of the chlorophyll, or in any case the absence of the primary material necessary for its regeneration, thus giving rise to the yellow coloration of the plant.

This hypothesis is based upon the data given by Mr R. ARDENT regarding the composition of the different parts of the oat plant during various periods of its life. On calculating the amounts of magnesium, calcium and potassium present, it was found that in proportion as the oat plant developed, a continually increasing quantity of oxide of magnesium became concentrated in the panicles. This amount reached the maximum 44.38 per cent of the total quantity of oxide in the plant, and its concentration took place at the expense of the leaves and the haulms, which gradually became poor in magnesium.

Further experiments made with wild clover have given positive results; in order to control them, experiments in emasculating oat plants were instituted at the Moscow Agricultural Institute. The result of these experiments was, that at the time of harvesting on August 1, the greater number of the emasculated plants were still green, while the control plants were already ripe. On determining the relative amounts of ash, phosphorus and sodium in the emasculated and non-emasculated plants, a considerable difference between the former and the latter was found; from this fact the following conclusion is drawn.

Accepting WILLSTÄTTER'S suggestion, it may be said that annual plants do not persist through a second season, because, after the harvest, their nutritive conditions, in the widest sense of the words, are not such as to admit of a resumption of life activity and especially because, as the plants mature, no migration has been observed of the important mineral magnesium from the grain towards the other parts of the plant. Thus if suitable conditions could be obtained for the plant, such as sufficient humidity, heat, and the mineral salts necessary for its nutrition, the plant would regain its activity and if it did not become at once a perennial, it would in all events yield a second cut.

The writer proposes to continue his experiments on the part played

by magnesium in the maturation process of plants, and intends to begin others on the rôles of phosphorus and potassium.

- 504 - **The Action of Superphosphates on the Root System of Plants.** — *Савина* (Work of the Agricultural Experiment Station at Sosny, Russia, in 1915, in *Сельскохозяйственное Лесоводство* (Agriculture and Silviculture) year LXXV, Vol. CCXL, pp. 395-398, Petrograd, November 1915).

This article refers to the experiments begun in 1912 by the Sosny Agricultural Experiment Station in order to study the effect of superphosphates upon the development of the root system of sugar beets. The results of these experiments were as follows :

- 1) The soluble phosphoric acid of the fertiliser, when applied to the black soils, is fixed by the stratum of soil on which it has been deposited so that no considerable movement of the phosphoric acid from one layer to another of the soil is observed.
- 2) The superphosphate applied to the soil greatly contributes to the formation of the very fine network of the roots of the beets, and the largest development of this root system is seen precisely in the layers in which the superphosphates have been applied.
- 3) Superphosphate has not been found to exert any more specific effect than nitrate and sulphate of potassium upon the root systems of spring wheat, autumn rye, or autumn wheat.

Having once definitely proved that superphosphates have a specific effect upon the root system of beets, the Station studied, in 1915, the action of superphosphates upon the root systems of the following plants: beets; rye and autumn wheat; spring wheat; oats; millet and maize. The plants were grown in Rotmistrow boxes of the following dimensions: 54×5 cms \times 54 cms high and containing each 16-17 kgs. of soil per box.

The general conclusions were as follows:

- 1) Of the plants which were the subject of the experiment, only the beets, and to some extent the millet, developed a very fine network of roots owing to the action of the superphosphates.
- 2) Nitrate and sulphate of potassium do not promote a greater development of the root system of beet roots.

- 505 - **Studies of the Formation and Translocation of Carbohydrates in Plants.** — *How* W. A., *DAISHI* A. J. and *SAWYER*, G. C. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VII, Part. 3, pp. 255-384, Cambridge, February 1916.

The object of these investigations was to throw light on the problem as to how carbohydrates are formed in the foliage leaves of plants, how they are transferred to the reservoirs where they are stored and how they are finally broken down and utilised in subsequent growth.

I. — THE CARBOHYDRATES OF THE MANGOLD LEAF.

Previous theories concerning the formation of carbohydrates in the leaf may be divided into two classes: 1) those favouring the view that saccharose is the first sugar formed in photosynthesis; 2) those in which the hex

are regarded as primary products, saccharose or starch being formed by synthesis either in the leaf or root.

Much of the previous work on this subject is of doubtful value on account of the insufficient care taken to ensure that no change in the carbohydrates could occur after the picking of the leaves and during the preparation of the sample for analysis. To overcome this requires the instantaneous destruction of the enzymes, which was effected by the writers as follows. Fresh-packed leaf material (about 1 kilogram) was dropped in small quantities at a time into a large volume (2 litres) of boiling alcohol to which 1 per cent volume (20 cc) of 0.880 ammonia was added so as to neutralise the acids present in the leaf. (If the solution does not remain alkaline more ammonia could be added). The destruction of the enzymes is facilitated by the ammonia which diffuses rapidly into the tissues. Further, the methods of estimating the carbohydrates were revised. Thus the enzyme of *Aspergillus oryzae* or taka-diastase was used in the estimation of starch, since the starch is only converted into a mixture of maltose and dextrose and there is no loss of dextrin. The cane sugar estimations were checked by inversion with invertase (autolysed yeast). Maltose was estimated by the use of malt-free yeasts, such as *Saccharomyces marianus* and *S. exiguus*, duplicate estimations being carried out with ordinary baker's or distiller's yeast. Dextroses were estimated by distilling with hydrochloric acid and weighing ethylalcohol produced as phloroglucide according to the Kuüber-Tollens method.

The polarimetric measurements were made at a constant temperature of 20°C by means of a thermostat.

The results obtained for the increase of the ratio of hexose to saccharose in passing successively from the leaf to mid-ribs and stalks suggest unmistakably that the cane sugar is formed in the leaf and undergoes a regular and increasing amount of inversion as it passes downwards to the stem. Thus in leaves picked in September (4 p. m.) there was 1½ times as much hexose sugar as saccharose in the leaf, whilst the mid-ribs contained 3¾ and the stalks 5 times as much reducing sugar as cane sugar. The inversion of the sugar in the mid-ribs and stalks is so rapid that practically the whole of the sugar in the sap of the roots is in the form of reducing sugar. This inversion of the cane sugar from the leaves is probably effected by the invertase shown to be present in the sieve tubes, but absent from the roots (ROBERTSON, IRVINE and DONSON, 1909, *Biochem. Journal*, IV, 258).

During the early stages of growth when leaf formation is the principal function of the plant and the roots are merely small tap-roots, the cane sugar is found to be in large excess of the hexose. Also, the proportions of maltose and laevulose in the mixture of reducing sugar in the sap is always approximately that of the products of the inversion of cane sugar. The writers consider these facts to outweigh all other arguments hitherto adduced to show that dextrose and laevulose are precursors of the cane sugar in the leaf. Even in plants like the potato, where starch is the reserve substance, and in the grape, where dextrose is stored, they find that when special precaution is taken in sampling to prevent the action of the leaf enzy-

mes, saccharose is the principal sugar of the leaf. The same is also true of the snowdrop, which stores starch and inulin.

One of the most striking features of the sap of the stalks and nodes is that the proportion of saccharose remains practically constant, while the hexoses fluctuate between wide limits. This points to the relatively rapid movement and formation of hexoses. If the sugars travel by simple diffusion, the rate of diffusion of the reducing sugars would be four times that of the cane sugar. Further, if cane sugar were free to wander through the tissues, diffusion would take place from the root (the place of highest concentration) to the stalks and leaves. It is therefore more probable that the cane sugar of the leaves is translocated entirely as hexose, and that there exists some mechanism in the roots preventing the cane sugar from diffusing out. GUTZERT (1911) showed that the protoplasm of the cell walls of the root was impermeable to cane sugar and that the death of the protoplasm is necessary before the sugar can be extracted.

As regards the mechanism by which saccharose is synthesised from hexoses, it is improbable that this change is effected by invertase by the process of reversible zymo-hydrolysis since invertase is entirely absent from the root.

II. — THE DEXTROSE-LAEVULOSE RATIO IN THE MANGOLD.

In the extracts of mangold leaves and stalks, optically active impurities are always present which are not precipitated by basic lead acetate and hence vitiate the estimation of the dextrose and laevulose. These substances are possibly acid amides (such as glutamine and asparagine) or amino acids (such as glutamic and aspartic acids) which form soluble lead salts. These impurities occur in the leaves, but are much more abundant in the nodes and stalks.

The "apparent dextrose" (D.) and the "apparent laevulose" (L.) are determined as percentages of the total matter dried in vacuo.

In the leaves the dextrose and laevulose appear to be present in approximately equal amount as would be expected if they were formed from saccharose by inversion. When the ratio D : L, departs from unity it is probably owing to the presence of a dextro-rotatory impurity (glutamine?) which increases the amount of dextrose apparently present, but at certain times of the day a laevo-rotatory impurity seems to predominate so that the ratio becomes less than unity.

In the mid-ribs and stalks, especially at the bottoms of the latter, the dextrose always appears to be in very large excess as compared with the laevulose; this is probably due to the proportion of the dextro-rotatory impurity being relatively greater in these parts than in the leaf, as is shown by the divergences between the polarisation and reduction values of saccharose being far greater.

The fluctuations of the apparent dextrose and apparent laevulose take place more or less regularly during the 24 hours, thus pointing to a regular variation in the optically active impurities.

Until more reliable results can be obtained for the true dextrose and laevulose by methods which are independent of the polarimetric data, it seems justifiable, from the results obtained to assume that the dextrose and laevulose exist in the leaves and stalks as invert sugar and travel in nearly if not exactly equal proportions to the root, where transformation into saccharose occurs. This assumption agrees best with the regular rise and fall of the total hexoses in the stalks and mid-ribs along almost straight lines during the night, as contrasted with the more irregular fluctuation of the apparent dextrose and laevulose taken separately.

Any conclusions as to whether either of these two hexose sugars is better adapted than the other to tissue formation or to respiration are valueless because analytical methods at present existing do not give true values for these sugars.

III. THE CARBOHYDRATES OF THE LEAF AND LEAF-STALKS OF THE POTATO AND THE MECHANISM OF THE DEGRADATION OF STARCH IN THE LEAF.

The variation of the carbohydrates in the potato leaf was studied throughout a complete 24 hours' period and the results obtained are summarised as follows:

In the potato leaf when the tubers are beginning to develop, the principal sugar present is saccharose: its amount increases from sunrise up to 2 p. m., following approximately the curve of temperature. It then falls during the rest of the day and night, the rise and fall being both linear. Hexoses are present in the leaf in very small amounts, generally less than 1 per cent of the total dry weight of the leaf. They fluctuate considerably during the early part of the day, the fluctuations being apparently determined by conversion into or formation from starch.

During the early part of the day up to 2 p. m. the proportion of starch changes very little, the small fluctuations which occur being related to changes in the starch which is apparently formed from the hexoses. Directly the amount of saccharose has reached its maximum at 2 p. m. the hexoses begin to increase in the leaf owing apparently to hydrolysis of the saccharose to invert sugar; at the same time "soluble starch" (or dextrin) is first detected in the leaf and its amount increases regularly up to 6 p. m. At 6 p. m., 2 hours before sunset the true starch in the leaf reaches a maximum value, far greater than any previous value during the day. The starch and "soluble starch" subsequently fall rapidly until between midnight and 2 a. m. the amount left is exceedingly small (0.2 per cent). The starch is apparently converted directly into hexose (dextrose), the amount of which increases in the leaf.

In the stalks, reducing sugars predominate greatly over the saccharose in spite of the fact that in the leaf the latter is in excess. As in the mangold, it is probable that cane sugar is the first sugar formed in the leaf and that it is hydrolysed by invertase in the venous mid-ribs and stalks for the purpose of translocation. Also, as in the mangold the presence of soluble, optically-active impurities vitiate the polarimetric data in estimating

the true proportions of dextrose and laevulose and the amount of saccharose. The fluctuation in the "apparent dextrose" and "apparent laevulose" in the leaf are due to the fluctuations in these impurities.

In the stalks, the amount of optically active impurity appears to be less than in the leaves so that the dextrose is actually in excess as it appears to be, thus indicating that the starch in the tuber is built up from this sugar. This is according to expectation, since starch becomes dextrose exclusively when hydrolysed by either acids or taka-diastase.

Maltose is invariably absent from the potato leaf, and also from the leaves of other plants which form much starch in the leaf. The degradation of starch in the leaves is therefore probably effected by a mixture of enzymes similar to the enzymes of taka-diastase.

506 — **Potato Selection by Means of Sexual and Asexual Reproduction.** — STUART WELLS, in *United States Department of Agriculture, Bulletin No. 95*, 35 pp. + 10 Plates. Washington, May 30, 1915.

The writer first sets forth the importance of potato growing in the United States, and the possibility of its further development. He then draws attention to the distinction that must be made between potato-breeding (here employed in the sense of sexual reproduction) and potato selection or the isolation and asexual propagation of desirable strains and types. Mr Stuart then gives a brief historical review of previous attempts made in the United States for the improvement of varieties of potato by means of sexual reproduction. He mentions the epoch-making work of GORRICH of Utica N. Y. (1857), who furnished the type "Garnet Chili", variety from which was produced "Early Rose" now a type of world-wide reputation. Other less important workers in this field may be mentioned; C. G. Pringle (of Charlotte Vt), E. S. Brownell (of Essex Centre, Ut.) and later, Alfred Reese, Luther Burbank and E. L. Coy.

After giving a detailed description of the structure of the pistil and stamens of the potato flower and the technique of artificial pollination, the writer describes the results he obtained from a series of crosses made in 1909 and 1910 and gives the parentage, number of flowers crossed, number of seed balls developed, percentage of success, and the number of seedlings that produced tubers. The chief conclusions drawn from these results are as follows:

- 1) The almost total failure of our present day commercial varieties to produce seed balls is due to male sterility rather than to imperfect pistils, or ovaries.
- 2) The number of ovaries developed in the flowers is smaller in the case of some varieties than in that of others.
- 3) The commonly accepted theory regarding the inadvisability of allowing more than one or two seed balls to develop on a cyme is not substantiated in 3 crosses which developed 5 and 6 seed balls each.
- 4) The Up-to-Date class of plants are, as a rule, poor seed-bearers and may be considered as belonging to the male-sterility group, therefore they cannot successfully be employed as pollen-plants.
- 5) Certain types or strains of a given class of plant possess greater

mutual affinity for each other and are more easily crossed than other strains or types, which are apparently as closely related.

e) The results of the crosses made by the writer do not justify Saman's assertion that white is not a recessive character.

In the 2nd part of his paper, the writer treats of the asexual selection of the potato. He gives a short historical summary of the work carried out in this direction and then discusses the results obtained from his own experiments in the 2 methods of selection: 1) the tuber-unit method, which consists in planting select tubers having the desired qualities; 2) hill selection, where plants possessing particular characters are chosen.

These results show that prudence should be exercised in advising asexual selection as a means of increasing the yield and improving the quality of the variety. The highest degree of success can only be attained by working with rather large numbers of the plants or tubers selected for production. The tuber-unit and hill-selection methods are chiefly valuable in pointing out the weak, unproductive, and diseased seed tubers, rather than in producing the rapid and infallible increase of the crop.

The Improvement of the "Washington Navel" Orange by means of Bud Selection (1). -- SHAMEL, A. D. (Bureau of Plant Industry, U. S. Department of Agriculture, in *The Journal of Heredity*, Vol. VII, No. 2, pp. 82-87, 1 fig., Washington, February 1916)

The results obtained from: 6 years of experiment; the observation of individual trees in plots of 100 trees; the study of individual tree-permanence record data secured by several orange growers.

These results have shown clearly that in the Washington Navel Orange variety we have a number of different types, many of which are undesirable and worthless. The younger groves, namely those that are farthest removed from the parent trees, show the largest proportion of these inferior types. The reason of this deterioration is to be found in the fact that of the 11 common types of the navel orange in California, the most undesirable ones from the standpoint of fruit production are those showing the greatest vigour of growth. The trees of this type throw unusually large numbers of suckers, which have, until recently, been highly prized for bud-wood. These undesirable trees have thus supplied a much larger proportion of the budwood than the more productive trees with less vigorous growth. It is difficult to secure large supplies of non-bearing bud-wood from the best trees, particularly the sucker growth, for such trees usually produce but little sucker wood. This difficulty is overcome by using fruit wood for propagation, for good trees produce more than poor ones.

It was found that in some of the best navel orange groves in South California, about 25 per cent of the trees are unproductive, or bear fruit of inferior quality; in some plantations there are even 70 per cent of such trees.

In order to propagate the most productive and valuable type of Washington navel orange, it is necessary to practise bud selection, which consists in securing buds only from those trees that have satisfactory per-

(1) See also B. January 1916, No. 87.

formance records as regards the regularity, abundance, and quality of the crop. This can only be done by keeping individual tree records which includes the numbering of every tree in the orchard, and the registration of the quality and quantity of the produce of each tree throughout a series of years. By this means, it is possible to know which are the less productive trees in the orchard and to locate the branches bearing little or no fruit, so that these trees may be replaced by the best types, usually by top working entire trees with carefully selected buds, or by the removal of the desirable limb sports by pruning. Uniform orchards can thus be obtained, that is to say, those with a larger yield, and in which the picking, sorting and handling of the crop is much simplified.

The writer has adopted the practice of cutting for bud wood only that growth which bears typical fruits. His large experience, and that of his collaborators, one of whom budded over 13 000 orange seedlings in 1914, has shown that even if the budsticks are of small diameter, the buds grow as well as the "fat" sucker buds. It is absolutely certain from the observations of the writer, that the buds from fruit wood secured from heavy bearing type trees produce trees with a much larger crop and with considerably earlier bearing habits than those propagated from sucker wood.

The writer recommends that the bud should be inserted, if possible as soon as it is cut. Spring budding, as a rule, gives the best results.

Bud selection improves the crops of all arborescent plants in the same way as seed selection permits of the improvement of herbaceous plants. By recording the performance of the progeny of select parent trees and noting whether sports, or off-type fruits, occur in the crop, it will be possible to base selection upon pedigree, instead of upon the performance of a single individual, and therefore the results obtained will be much more certain.

508 - A Fruit of *Juglans regia* Containing a Kernel of *Corylus Avellana*.

DANIEL L., in *Revue Générale de Botanique*, Vol. XVIII, No. 325, pp. 11-14. Paris, January 15, 1916.

The writer has examined a walnut showing a very peculiar anomaly: its kernel was replaced by a hazel-nut kernel united to a peduncle by a long filament just as in the hazel-nut. The origin of the specimen permitted of no doubts as to its authenticity; it came from a cultivated walnut tree whose branches interlaced with those of a neighbouring hazel. The shell although abnormal, of conical form and entire, was not very remarkable for such external anomalies occur fairly frequently, and even impart habitual specific characters upon the embryo.

This extraordinary seed was planted with a view to studying its germination, and the type of plant which it might produce. The cotyledons were unequal in size, the larger one being bent back over the smaller, thus preventing the radicle from emerging freely, which only became possible

(1) Cf.: Jean Daniel, Héritéité des sexes chez certaines races de haricots, in *Revue Générale de Botanique*, June 1, 1914. (Ed.)

the removal of the cotyledons; the leaves, stem and root were exactly like those of the walnut. Unfortunately, these observations could not be continued, as the seedling perished through the carelessness of the experimenter.

In order to explain these singular facts, the writer refuses to admit the thesis of a *monstrosity* producing a hazel-nut in the place of a walnut. His suggestion which appears to him plausible is that of a natural hybrid between the walnut and the hazel. Although the date of the maturity of the sexual organs differs in the two species, still the hazel pollen might retain its vitality for a certain time, and the period of the formation of the ovule is fairly long. Thus, it is not, *a priori*, an impossibility that the hazel pollen should have fallen on the female inflorescence of the walnut, remained there alive, until the moment of the maturation of the ovule, when it would fertilise the ovum.

The writer suggests fertilising the walnut artificially with hazel pollen, and the latter until the right moment for placing it upon the mature ovule of the walnut, after having removed all the male catkins before they are opened. Such an experiment should give interesting results.

The Composition of Italian Wheats. TOMMASI G., MARCONA G. and SIKS A. V. *Atti della R. Stazione Chimico-industria sperimentale di Roma, Series II, Vol. VIII, No. 71, Rome, 1910.*

CEREALS
AND PULSE
CROPS.

The writers first examine the question of wheat-growing in Italy and its importance, not only of the quantity of the crop, but also of its composition. They then set forth, in a series of carefully compiled tables, the results of the analyses of wheats from the crops from 1910 to 1914, coming from different parts of Italy, and consisting of the most important Italian wheats, viz:

Soft wheats: Bianchetta -- Calbigia -- Campio -- Carosella -- Cologna di Aversa -- Fucense -- Gentil Bianco -- Gentil Rosso -- Maiorca -- Awned Marzuolo -- Aducco (awned Aducco spring-wheat) -- Marzuolo Ferrara -- Ferrara spring wheat -- Marzuolo Veronese (Veronese spring wheat) -- Solo Americano (American spring-wheat) -- Nocè -- Rieti -- Roma -- Rosso d'Olena -- Rosso piemontese.

Hard wheats: Bianceneria -- Capoterra -- Castiglione -- Duco di Puglia (Apulia hard) -- Gigante -- Marzuolo -- Russia -- Sambucato -- Salsotto -- Timilia -- Vincetutti.

The total number of samples analysed were 60 (12 soft and 48 hard).

From the results obtained, the writers found the average minimum and maximum values for the soft and hard wheats cultivated in different parts of Italy, and which are given below.

There are very considerable variations in the content of nitrogenous matter, nevertheless it never falls to a very small value, as may be observed in the wheats of other countries, which sometimes contain less than 10 per cent of nitrogenous matter. The dry gluten content was never below 8 per cent, the amount required for bread-making. It should be noted that the proportion of gluten : nitrogenous matter varies within fairly wide limits; thus, there is not a perfect agreement between

these two sets of figures, so that it is not always the wheats which are richest in the total amount of nitrogenous matter that have the highest gluten content. The weight of the bushel does not vary much, and the averages are fairly high. The aleurone content of the ten is sometimes below 25, as calculated by BOLAND's aleurometer. It is well-known that this method of estimation is not very satisfactory, but the writers have only used it in comparing the results with those obtained from foreign wheats that had been previously analysed. The determination of the water content (on an average somewhat low) the nitrogen matter, cellulose, ash, phosphoric acid and pentosans gave no striking results as compared with the analyses of foreign wheats.

Composition of Italian Wheats.

	Soft Wheats			Hard Wheats	
	Maximum	Minimum	Average	Maximum	Minimum
Weight of the bushel . . . lbs	65.8	57.7	63.3	67.1	60.6
Weight of 100 grains . . . gr	6.3	3.5	4.86	6.5	4.3
Dry gluten %	16.6	8.3	10.6	16.6	9.0
Aleurometric figure	40.0	25.0	—	3.0	25.0
Humidity %	14.43	9.17	12.19	12.79	8.91
<i>In 100 parts of dry matter:</i>					
Fats (ether extract).	2.68	1.82	2.27	2.70	1.83
Nitrogenous matter ($N \times 6.25$). . .	18.23	10.79	14.90	19.05	12.04
Cellulose	3.98	2.10	2.77	4.02	2.17
Ash	2.47	1.75	2.10	2.85	1.50
Non nitrogenous extract (by diff.) .	82.34	74.35	77.96	80.21	72.97
Pentosans	10.0	6.72	8.16	10.68	5.02
Phosphoric acid	1.36	0.71	0.93	1.13	0.63
Proportion dry gluten: nitrog. mat.	1.08	0.65	0.79	0.98	0.70

On observing the averages, it is seen that hard wheats have a higher nitrogen content than soft wheats, although the two figures giving the maxima and minima are much higher in hard than in soft wheats. This accords with WUFLART's statement:

"It is not true that a wheat ought always to be very rich in nitrogen; it should on the contrary be remembered that hard wheats are distinguished by their special consistency alone, and by their flour possessing particular properties that do not depend upon their content of nitrogen matter".

In conclusion, it may be observed that Italian wheats, in general, are of good physical qualities and excellent chemical composition; they are distinguished from many foreign products by their high nitrogen content.

Spring Wheat Sowing in France: Manitoba Wheats and Rieti Wheat. — I. *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. II, Nos. 4-6, pp. 82-84, 1914-15. Paris, January-February 1916. — II. *Bulletin de la Société d'Encouragement à l'Industrie nationale*, Vol. 125, No. 1, pp. 158-160. Paris, January-February 1916. — III. *Journal d'Agriculture pratique*, Year 86, new Series, Vol. 29, No. 87, p. 101. Paris, March 11, 1916.

I and II. — The *Journal Officiel* of January 21, 1916 has published the statement of the sowings of cereals in the autumn of 1915. The data were obtained by an enquiry made by the Ministry of Agriculture. The figures show a decrease of 1826-143 acres, or of about 10 per cent of area devoted to autumn cereals (wheat, rye and meslin (a mixture of wheat and rye), winter oats and winter barley), in comparison with the year of 1914, and a decrease of about 4200-870 acres in comparison with normal area under wheat in the years before the war. The problem of sowing of spring wheat is therefore one of particular interest to France this year.

As the best varieties of spring wheat, are mentioned: Noé, and still its derivatives, Japhet, blé Dieu, Gros Bleu, Barbus à gros grains, Craux, Pithiviers, Gironde. But since spring wheats are only grown on small areas in France, it is not easy to obtain seed. It will therefore be necessary to have recourse to foreign wheats, notably those of Manitoba which are in great favour with the French millers, and are much to be recommended. Manitoba wheats are certain to succeed in France wherever spring wheat can be grown. On account of their early ripening, they can be sown there up to the middle of April, or even a week or fortnight later, and where there is no fear of drought, in fact, the atmospheric humidity of their country of origin justifies the belief that these wheats are relatively resistant.

Manitoba wheat has been tested in Switzerland, where the growth conditions of winter wheats are generally less favourable than in France, but in French and in German Switzerland, farmers use Manitoba wheat every year with success for spring sowing: on good soil they can count on from 37.2-44.6 bushels of grain per acre, and from 1.6-1.9 tons of grain per acre.

III. While fully recognising the importance of trying Manitoba wheats for spring sowing, M. GÉNIN is of opinion, that it would be well to first sow varieties that have already been tested in France, and of which the success is certain. Such a wheat is the Rieti variety: it is early and productive. It is more than 20 years ago since the writer introduced it into the marshes of Bourgoin and Isère (18 533.25 acres). Before the introduction of this wheat, the cultivators of this district, which was drained in 1877, had, in the native wheats, only varieties with small grain, and stems liable to rust; but since Rieti wheat has been introduced (which spread very

rapidly over the drained marsh), grain of first quality has been obtained both from autumn and spring-sown varieties.

M. SCHRIBAUX has tested this Rieti wheat, and has crossed it with a prophet, thus obtaining, some years ago, an awnless hybrid which this year is growing successfully, and which he will soon be able to propagate on a large scale.

511 - **Rice-Growing in Italy.** — NOVELLI NOVELLO, in *Il Giornale di Rist. Agric.*, No. 5, pp. 99-104. — *Geographical Map*, Vercelli, March 16, 1916.

In Europe, Italy is the country which occupies the first place in the development of rice-growing, about 380 665 acres being under this crop annually while 27 000 000 bushels of paddy are produced giving a value, together with that of its by-products, of over £ 6 000 000. It is estimated that rice is grown in rotation on about 2 223 000 acres of irrigated land.

In 1911, about 2 128 000 bushels of prepared rice were exported, which the value was more than £ 1 200 000. Not very long ago the crop was of still greater importance, during the five-years period 1875-1879 it occupied 573 295 acres. Rice growing afterwards decreased, on account of the severe competition of Asiatic rice, great injury due to diseases. The rice growing provinces, in decreasing order of the area cultivated at present the following: Novara, Pavia, Milan, Bologna, Mantua, Reggio, Verona, Ravenna, Alexandria, Cremona, Venice, Reggio d'Emilia, Udine, Padua, Ferrara, Vicenza, Modena, Bergamo, Syracuse, Catanzaro, Naples. Rice-growing tends to decrease a little in the north where it was most extended, with the gradual transformation of permanent rice fields into rotation rice fields, and also with the adoption of a systematic succession of crops increasing the unit production. On the other hand, rice-growing is noticeably extending in some irrigated districts where it had been of little importance. This is due, not only to its utility in clearing the ground from weeds, but also to the profit derived from the product. Rice is especially cultivated in the Provinces of Bologna and Ferrara, and in the low lying zones of Venetia, where it assists in the annual reclaiming of waste marsh land, for rice is often the first true crop in the agricultural improvement of this land.

This work of reclaiming the numerous marshes, or lands periodically subject to flooding, which exist in Italy, can be increased in future, due to the transplanting method which the experimental Rice-Growing Station at Rieti (directed by the writer), has, after study and experiment already introduced and popularised in Italy. This system allows of being grown, even on land that is always slightly submerged, or which is subject to flooding in spring, and where a sown crop would be injured or very soon destroyed.

512 - **Gram Cultivation (*Cicer arietinum* L.) in India.** — HOWARD MILES, GABRIEL L. C. and ABDUR RAHMAN KHAN, in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VII, No. 6, pp. 215-235, 2 figs., Calcutta. This Bulletin is entirely devoted to the study of the cultivation of gram in India where the area under this plant every year is a

25,000,000 acres. The grain is an important food for man and cattle, while the dried stems and leaves are used as fodder.

The factors affecting the yield are: the nature of the soil; the special conditions of the climate at the flowering season; the time of sowing; and the specific productivity of the different types.

The distribution of gram depends chiefly upon geological and agricultural conditions; this plant requires a light, open, well aerated soil for the normal development of the root system and the formation of nodules. In heavy, argillaceous, moisture retaining soil, gram grows with difficulty, the root-system is very superficial and only a few pods set seed. Thus on the alluvial district of the Gangees gram is only grown on 170,000 acres, as against 175,433 acres in the Province of Agra where the soil is a somewhat sandy, open, well drained loam passing towards Bengal into an exceedingly fine silt of high moisture retaining capacity. As the soil alters in texture towards Bengal, so the area under gram falls, on such soils, the shallow-rooting, erect and early flowering varieties should be grown, in order that the roots may not encounter, in their growth, increasingly disadvantageous conditions likely to greatly impede their development.

Another factor that has much effect on *Cicer arietinum* is the damp due to wet and cloudy weather which, when it occurs during the flowering season, prevents the setting, as is shown by the following data.

Variety	Effect of rainy weather on setting			Effect of fine weather upon setting		
	No.	No. of	Percentage	No.	No. of	Percentage
	of flowers	Pods formed	set	of flowers	Pods formed	set
Type 23,	18	2	11	18	15	83
Large Kabuli	18	4	22	18	13	72
Type 22,	21	5	25	21	17	81
Type 21,	19	1	5	19	12	63
Type 20,	20	9	45	20	18	90

The time of flowering is of importance in several ways and should be taken into consideration; in all selection work, preference should be given to the types flowering at the end of the cold weather, when the season begins to change and the days are generally bright and warm, thus promoting pollination. There is then ample time for the seed to set before the hot damp winds begin. Excessive earliness in flowering is associated with low yielding power, while on the other hand, very late flowering is a disadvantage, as a rapidly ascending temperature interferes with the normal development of the grain.

As regards the date of sowing, the best results were obtained at Pusa when the crop has been put in rather late, during the first week in November, by which time the light lands have had time to lose a good deal of their moisture. Late sowing, as has been seen, checks excessive vegetative growth developed at the expense of seed production. The yield of seed depends upon the productiveness of each variety. The large seeded varieties have only one seed in each pod. The colour of the seeds varies from white to black through various shades of yellow and red. The lighter the colour of the seeds, the higher their price; thus the colour is a new element serving as a guide in the work of selection.

The white gram, type No. 9, is interesting from its habit, which is very spreading with numerous side branches. This type unites both yield and quality; it has been grown for 4 years at Pusa, and under the most different soil and climatic conditions has always yielded an average of over 20 maunds (1642 lbs) per acre.

The writer finally gives a classification and description of the various types, 25 of which have, so far, been isolated at Pusa, and are distinct in habit, size and colour of flowers, the shape and colour of the different parts of the corolla, as well as in the colour and dimensions of the leaves and seeds.

513 — Experiments Carried out in 1915 by the German Station for Potato Cultivation.
— VON ECKENRECHER F., in *Zeitschrift für Spiritusindustrie*, Year 1916, Suppl. V, pp. 1-52. Berlin, 1916.

In 1915, the above-mentioned Station ("Deutsche Kartoffel Kultur station" directed by the writer) tested 19 varieties of potatoes on 32 fields situated in different parts of Germany, namely: East and West Prussia; Posen; Pomerania; Brandenburg; Silesia; Prov. of Saxony; Brunswick; Hanover; Anhalt; Kingdom of Saxony; Hesse; Bavaria; Württemberg; Grand-duchy of Baden. A new experiment field was started in West Prussia. The experiments proceeded sufficiently normally to give reliable results.

In these experiments, each variety occupied a plot of 2.5 ares (37 square yards). At the time of ploughing, in autumn, or the beginning of winter, an amount of stable manure corresponding to about 318.5 cwt per acre was dug in. Subsequently in the spring, 35.68 lbs. of soluble phosphoric acid and 28.54 lbs. of nitrogen were added.

The number of seed potatoes used should, if possible, be the same for all varieties; and all the potatoes ought to be planted at the same time, but the Station gives no directions as to the method of cultivation.

During the summer, the experiment fields should be cleared of weeds and well cared for. They are superintended by an inspector, who at the same time gives the farmers advice to insure the satisfactory development of the plants.

The lifting, sampling, estimation of the diseased tubers and the estimation of the starch content, etc., are carried out according to the directions given by the Station; these are reproduced by the writer.

(1) The results of the 1914 experiments are summarised in *B.* May 1915, No. 495. 14

STARCH CROPS

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Classification According to Starch Yield

Varieties	Tuber yield		Amount of Starch %	Ripening	Varieties	Amount of Starch %		Ripening	Tuber yield		Ripening
	cwt.	per acre				cwt.	per acre		cwt.	per acre	
1 Deodora	258.2	45.8	18 %	semi-late	1 Parnassia	19.7	251.9	49.6	semi-late	251.9	semi-late
2 Parnassia	251.9	49.6	19.7	"	2 Deodora	18	258.2	45.8	"	45.8	"
3 Urus	226.4	41.7	18.4	late	3 Roodle Star	19.8	211.6	41.9	late	41.9	late
4 Gelymin	222.9	40.3	18.1	semi-late	4 Urus	18.4	226.4	41.7	"	41.7	"
5 Prof. Gerlach	211.6	38.7	18.3	"	5 Gelymin	18.1	222.9	40.3	semi-late	40.3	semi-late
6 Roodle Star	211.6	41.9	19.8	"	6 Wohltmann 34	19.1	206.6	39.8	late	39.8	late
7 Prof. Gerlach	205.4	38.6	18.7	"	7 Prof. Gerlach	18.3	211.6	38.7	semi-late	38.7	semi-late
8 Wohltmann 34	204.1	39.8	19.1	late	8 Boehm's Erfolg	18.7	208.4	38.6	"	38.6	"
9 Prof. v. Eckenbrecher	204.1	39.7	18.1	semi-late	9 Pras. v. Kitzling	18.1	193.0	35.2	"	35.2	"
10 Pras. v. Eckenbrecher	195.0	35.2	18.1	"	10 Attyk	18.4	184.5	34.2	"	34.2	"
11 Gertrud	191.1	34.1	17.9	"	11 Gertrud	17.9	191.1	34.1	late	34.1	late
12 Excellenz	190.7	32.6	17.9	"	12 Laurat v. Ravenstein	18.1	180.1	32.6	semi-late	32.6	semi-late
13 Attyk	184.5	34.1	18.4	late	13 Excellenz	17.0	190.7	32.6	"	32.6	"
14 Richter's Imperator	182.7	31.3	18.2	semi-late	14 Prof. Wohltmann	18.5	173.9	32.4	late	32.4	late
15 Landrat v. Ravenstein	180.1	32.6	18.1	"	15 Richter's Imperator	17.3	182.7	31.3	"	31.3	"
16 Geheimrat v. Kumber	173.9	29.6	16.9	"	16 Prof. v. Eckenbrecher	15	204.1	30.2	"	30.2	"
17 Prof. Wohltmann	173.9	32.4	18.5	late	17 Geheimrat v. Kumber	16.9	173.9	29.6	"	29.6	"
18 Labersche	141.4	25.2	17.8	semi-late	18 Labersche	17.8	141.4	25.2	"	25.2	"
19 Zukunft	112.8	17.8	15.5	"	19 Zukunft	15.5	112.8	17.8	"	17.8	"
Average	240.4	—	—	—	Average	17.9	—	—	—	—	—

Period or Year	Average yield of tubers in cwt. and lbs per acre		Average Amount of Starch %	Average % of Starch lbs per acre
	cwt	lbs		
1888-1892	171	78	19.0	32.7
1893-1897	185	80	18.9	39.1
1898-1902	200	—	19.0	42.0
1903-1907	187	56	18.2	38.0
1908-1912	181	28	18.1	37.0
1913	212	56	17.5	41.0
1914	166	108	18.3	35.7
1915	196	48	17.9	40.0

In 1915, the weather at the beginning of the growing period was favourable to potato cultivation; later, owing to the copious rain, the vines, haulms, and tubers were able to develop well; starch formation, however, hindered by the rain; and towards the end of September frosts injured the late varieties.

In Table I, the various kinds are classified according to their tuber and starch yield per acre, while in Table II, the results obtained in 1915 are compared with those of the preceding years. From these data it appears, that in 1915, the average tuber yield per acre of all the varieties exceeded by 3291 lbs. that of 1914; while the amount of starch was per cent lower, and the starch yield per acre exceeded 5085 lbs. Among all the years of experiment, 1915 occupies: the 9th place as regards tuber yield; the 20th for the amount of starch; the 12th for the starch yield. The tuber crop in most fields exceeded the 1914 crop, but on account of rainy weather, the amount of starch had decreased.

A certain number of varieties that had given satisfaction in previous years were disappointing in 1915 and vice-versa. The sorts giving good results in the previous years (including 1915) are:

Deodara (tested twice) — Ursus (once) — Gedymin (once) — Gerlach (3 times) — Roode Star (3 times) — Prof. Eckenbrecher (4 times) — The Parnassia variety was grown for the first time in 1915.

The following kinds, which were still satisfactory in 1913 and no longer did well in 1915:

Präsident Klitzing — Gertrud — Excellenz Attyk — Ländrat Ravenstein — Geheimrat von Rümker — Zukunft never gave good results and must be considered as the least satisfactory.

With regard to resistance to disease, the writer remarks that the largest number of diseased tubers were observed in the following varieties:

Geheimrat von Rümker (5.5 per cent of diseased tubers) — Präsident Klitzing (4.5 per cent) — Dabersche (3.7 per cent) — Richter-Rattor (3 per cent).

The smallest number of diseased tubers were found in:

Deodara — Gedymin and Prof. Wohltmann (0.5 per cent) Wohltmann 34 — Roode Star — Boehm's Erfolg (0.4 per cent) — Parnassia 2 per cent).

The writer also mentions the frequency of the occurrence of the different diseases (Phytophthora etc.) in the case of different varieties of potatoes.

The tubers, when stored in cellars, kept fairly well, both in 1914 and 1915, and from this point of view, may be classified as follows.

Good to very good: Deodara — Wohltmann 34

Good: Prof. Gerlach Gedymin — Prof. Wohltmann Excellenz — Ursus — Gertrud — Attyk.

Fairly good to good: Landrat von Ravenstein — Dabersche Prof. Eckenbrecher — Präsident von Klitzing — Roode Star Zukunft.

Fairly good: Geheimrat von Rümker — Richter's Imperator.

In conclusion, the writer gives information regarding the general value of each variety, and its value as an article of human food.

41. **Breeding of Drought-Resistant Millet and Sorgo in the Great Plains Region of the United States.** — DILEMAN A. C. in U. S. Department of Agriculture Bulletin, No. 201, 10 pp., 2 plates, Washington, January 25, 1916.

FORAGE CROPS
MILLET
AND SORGO

It has been found by experience that successful farming in the Great Plains region must include the raising of live stock. This necessitates the production of forage crops under cultivation, since except in sand-hill regions and along the water courses, the native grasses do not grow tall enough for hay. The wild short grasses that cover the Plains usually produce feed for summer pasturage, but cultivated crops must be depended upon for winter feeding. In the northern Great Plains, certain perennial crops — lucerne and species of *Bromus* — give good results, but farther south, the annual forage crops, millet and sorgo especially, are the most dependable and have proved drought resisting and capable of producing profitable crops where the annual rainfall averages from 12 to 18 inches.

The drought-resistance of millet is largely due to its early maturity and low water requirements, while sorgo has in addition to these two valuable characteristics, a remarkable ability to endure drought. Even though its growth is severely checked during a period of drought, it will resume growth upon the return of favourable conditions. It has been shown that millet and sorgo require less water for the production of a ton of hay than any other crops that have been tested in the central Great Plains.

BRIGGS and SHANTZ found from practical experiments carried out at Belle Fourche (S. Dak.) that in order to produce a given quantity of dry matter, millet had a water requirement of 249, as compared with 460 for wheat and 735 for lucerne. In experiments conducted at Akron (Colo.), the same writers found that the water requirement of sorgo is only slightly higher than that of millet.

The "Kursk" and "Siberian" varieties of millet have given larger

yields of hay than other varieties of this crop tested in the northern Great Plains. In each of these varieties, a strain has been selected which is believed to be much superior to the parent stock. One of these selections, "Dakota Kursk millet" is an early variety of good forage type. The plants are 30 to 34 inches high when mature, have a number of rather fine stems and many leaves. The yield of hay from this variety has averaged 2.1 tons per acre at Akron (Colo.) and 1 3/4 tons at Newell, S. Dak. In seed production this variety is excellent, producing under ordinary conditions from 15 to 25 bushels per acre. The seed head is close and firm and does not allow the seed to be shed readily. "Siberian millet" is a larger type of millet than "Dakota Kursk", growing from 36 to 40 inches high. It has coarser stems and leaves and makes a somewhat poorer quality of hay. It does however produce a larger yield per acre than the "Dakota Kursk" while the seed sheds more readily. In regions of greater rainfall, this variety may be more valuable than "Dakota Kursk" on account of its higher yield, but for the northern Great Plains it is believed that the latter variety is the better type.

A strain of early sorgho is much needed for cultivation in the northern Great Plains, where at the present time very little sorgho is grown. A strain of sorgho has been developed by selection which is especially promising for this region and for higher altitudes farther south in the Great Plains. In favourable seasons, the large growing sorghos produce a heavier yield than this dwarf type, but in dry seasons, the latter will yield at least as heavily as the larger varieties. This type is very early, maturing seed in a period of about 90 days, and can often be used as a catch crop where other crops fail. It produces seed freely, and the farmer can easily raise his own supply of seed for forage planting. On account of the smaller size of the plants, this dwarf sorgho can very well be planted thicker than the larger growing varieties. This new variety has been named "Dakota Amber Sorghum".

Sorghum will probably produce a heavier yield of fodder than any other annual forage crop of this region. At Akron (Colo.) sorgho has produced 40 per cent greater yields than millet. At Newell and Ardmore (S. Dak.) the results have also been in favour of sorgho. In a 7 year test at Newell, sorgho produced 51 per cent more fodder than maize. "Dakota Amber sorghum" has produced on the average 40 per cent more forage per acre than "Sudan grass" (1) in tests at Newell, Akron, Ardmore and Mandan.

It is believed that "Dakota Kursk" millet and "Dakota Amber Sorgho" will prove valuable additions to the list of forage crops adapted to the north and central Great Plains.

515 - *Sorghum (Sorghum exiguum f. maxima) in North Africa* (2). - *Travaux de la Station Agricole et Viticole*, Year 23, No. 10, pp. 235-237. Paris, March 5, 1916.

The sorghum called in the United States "Sudan Grass", and "Turkish Grass", and which comes from Khartum and Algiers, is very nearly

(1) See also B. July 1913, No. 799.

(2) See also B. January 1916 No. 42.

(Ed.)

(Ed.)

related to the wild form *Andropogon halepensis* with which it has been confused, although different in several characters. Thus, while the Aleppo sorghum has spreading rhizomes which form a coarse dogs-grass much disliked by cultivators, *Sorghum exiguum* does not spread and its stem is straight and of small diameter, thus justifying the name of *Holcus exiguus* under which it is described by FORSKAL in the *Flora Aegyptio-arabica*. The inflorescences are sometimes very reduced, as in the Egyptian type, or large and diffuse. The spikelets are always jointed, and are easily detached when ripe.

In Kabylia, the writer observed a very tall variety called "Mezza" by the natives, which seems to mark the transition to the cultivated forms, although it undergoes no modification when cultivated.

Sorghum exiguum f. *maxima* is well suited to southern climates and to more or less arid soils; on damp soil, or one that is irrigated, it can yield at least 2 cuttings. It grows well in association with a leguminous plant; with *Dolichos Lubia* or with *Soja*, sorghum has given good results. The grain is easily harvested; it is only necessary to cut the ripe inflorescences and expose them in a dry place; then when they are shaken, the seeds which were previously enclosed in the glumes at once fall out, as in the case of the broom sorghum and the sugar sorghums.

Feeding experiments have shown that no bad effects are produced if the sorghum is cut after flowering, and fed to cattle 24 hours after being cut.

195 ***Gossypium Paolii* n. sp. and *G. Benadirense* n. sp. New Varieties of Indigenous Cotton in Italian Somaliland.** -- MATTEI G. E., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. II, Part 4, pp. 221-224. Palermo, 1916.

FIBRE CR.

In 1908, the writer declared to be identical with *Gossypium obtusifolium* Boxtl. var. *africanum* Watt, a cotton plant growing wild in the district of Mogadiscio (Italian Somaliland) and which is perhaps a natural and fertile cross of sufficiently fixed characters between the true *G. herbaceum* L., the variety first cultivated in Africa) and *G. Stockii* (mentioned as growing wild in Arabia and perhaps in some parts of East Africa). On examining the collection of *Malvaceae* made in Somaliland in 1913 by Prof. G. Paoli, the writer discovered the existence of 2 other species of cotton which are new to science and which he described under the names of *G. Paolii* and *G. Benadirense*.

These 2 varieties are very similar to one another, and are without doubt wild, native plants that have not been affected by any crossing.

197 - **Arborescent Cotton Plants** (1), -- RIVIÈRE C. in *Bulletin de la Société Nationale d'Acclimatation de France*, Year 63, No. 2, pp. 46-55. Paris, February 1916.

Basing his opinion upon the history of the 2 arborescent cotton plants "de Motril" and "Caravonica", the writer maintains that the cotton

(1) See Bulletin de la Société nationale d'acclimatation de France, March 1, 1914, 138 et seq. (Ed.)

plant is capable of infinite variation, especially as regards its general aspect, and that it is much affected by its environment, and the method of its cultivation. From this it results that the habit, the shape of its leaves, the size of its inflorescence, as well as the length and character of its staple are not fixed characters upon which economic cultivation can be based, but that preliminary experiments are necessary in order to determine the qualities of the plant. The writer regards the "de Motril" cotton plant as nearly related to *Gossypium Hardyum* described by TONAL as coming from the Algiers Experimental Gardens and which, according to the writer, is a long stapled "Georgia" much resembling the "Sea Island" variety, from which also "Caravonica" is derived. The latter upon which such great hopes were built, had a strong tendency to degenerate into common varieties, and under various circumstances gave disastrous results. As experimental proof of his hypothesis, the writer reminds us that some neglected plants of *Gossypium herbaceum*, found by him on the dunes of Biserta, produced, in the Algiers Experiment Garden individuals with luxuriant growth which certainly did not look as if they had a common origin. On the other hand, in the reverse experiment, plants raised from the seed of equally fine individuals, when left to themselves under unfavourable soil conditions and without any care, produced offspring to which different origins, both as regards country and race would certainly have been attributed.

518 - **The Introduction of the Cultivation of Egyptian Cotton into the South West of the United States.**—SCOFIELD T. H., KEARNEY T. H., BRAND C. S., COOK O. C. and SWITZER W. T. (Committee on Southwestern Cotton Culture), in *U. S. Dep. of Agr. Bulletin* No. 332, pp. 1-30. Washington, January 13, 1916.

This publication of the "Committee on Southwestern Cotton Culture" dealing with the establishment of Egyptian cotton production in the Salt River Valley (Arizona) is of more than local interest, since it offers a good illustration of the numerous biological, agronomic, social and economic difficulties encountered in developing a new agricultural industry and furnishes suggestions as to how these problems may be successfully solved. In the course of the work carried out under the direction of this Committee, it has been shown that cooperation is the key-note of the success of the present enterprise. In this instance, cooperation has been maintained chiefly along the following lines:

- 1) Among the investigators, who had to solve special technical problems and coordinate the results in such a manner that their collective judgment should point out the general line to be followed.
- 2) Among the growers, in order to make it possible to produce and market the crop economically and to maintain the uniformity and high price of the variety grown.
- 3) Between the growers and the investigators, to make it possible to put into effect, without delay, the most improved methods of production and marketing. This cooperation has been maintained by personal contact, by keeping on the spot the field agents of the Department of Agriculture who have worked constantly in the community. These agents have been

for the direct control of the Committee, some of the members of which made frequent visits to the salt River Valley plantations. The attitude of the officers and members of the growers' associations in their co-operation with the Department of Agriculture has been of the most cordial and helpful character, and has been a very important factor in the establishment of the industry.

4) Between the cotton manufacturers and the investigators represent the growers' associations. Spinning tests have been made and information of a technical and commercial nature given. This information has led the growers to better methods of packing and of managing the crop generally, and has given the investigators helpful suggestions in connection with the work of selection.

Some of the manufacturers interested in the new type of native cotton, visited the plantations, while representatives of the growers visited the mills where the cotton was being utilised.

The policy of the Department of Agriculture in encouraging the production of Egyptian cotton on the community basis, is beginning to be appreciated by manufacturers and buyers, many of whom now realize that in order to obtain a constant type of long-stapled cotton, they must look for localities where the farmers are organised to grow only one kind of cotton, prevent deterioration of the type by seed selection, and to class and market their crop as a whole.

Experiments in Growing *Arachis hypogaea* in Eastern Uruguay. FERNANDO JUAN, in *República oriental del Uruguay*, Ministerio de Industrias, Inspección Nacional de Ganadería y Agricultura, Boletín No. 17, 18 pp. + 2 figs. + XVIII Plates, + 4 diagrams, Montevideo, 1916.

CROPS YIELDING OILS, DYES AND TANNINS

Experiments carried out by the "Laboratorio agronómico de la Inspección Nacional de Ganadería y Agricultura", of which the writer is director.

In Uruguay, the ground nut is cultivated on an area of scarcely 3700 acres and the crop forms an unimportant article of export. With a view to obtaining what chance there would be of extending this industry, the writer grew the 2 varieties wrongly called "Asiatic", and "African" or "Japanese", on 10 plots of the experiment field at Sayago. Each plot was treated differently, and the seed was sown at the rate of 80 lbs. per acre at the beginning of November; the harvest taking place at the end of April, or the beginning of May.

In a series of tables are set forth: the cultural operations; the analyses of the seed; the analyses of the crop; analyses of the soils used in the experiment; the meteorological data.

The yield varied from 1829 to 2428 lbs. per acre in the case of the 4 best plots and between 613 and 1331 lbs. per acre in that of the others. The set of figures agrees with the normal crops obtained in countries where this is usually cultivated. It must, however, be remembered that the seed was sown late and that the distribution of the rainfall was abnormal (5 in.), during the whole growing period of November-May. Superficial cultural operations proved useful in the experiment field where the soil

was more or less compact. Some of the chief data contained in the table vary within the following limits :

Proportion between husk and seeds . . .	{	Husks	25.00
		Seeds	75.00
Water Content	{	Entire fruit	6.00
		Seed: "Asiatic" var.	8.00
		Seed: "Japanese" var.	10.00
Yield of Oil	{	Entire fruit dry	26.00 = 1.00
		Seed: "Asiatic" var.	47.50 = 4.84
		Seed: "Japanese" var.	41.88 = 4.34
Analysis of seeds	{	Protein	20.81 = 26.00
		Ash	2.00 = 2.00

The writer recommends the cultivation of the ground-nut on every uruguayan farm, on a small scale, for home consumption. The experiments (which will be continued), have already shown that this plant is very well adapted to the country.

520 - Experiments in the Royal Colonial Gardens at Palermo on the Cultivation of Sunflowers Imported from Russia. — TROPEA C., in *Bollettino di Studi e Ricerche del R. Giardino Coloniale di Palermo*, Vol. II, Part 4, pp. 214-220. Palermo.

While continuing the experiments in growing sunflowers imported from Russia in the Royal Colonial Gardens at Palermo (1), it was noticed in 1915, that the 2nd generation of the plant had become differentiated in 3 forms having respectively black, white, and spotted seeds. The seeds that came from Russia were all spotted and retained this character even in the 1st harvest. Any possibility of crossing having taken place during the experiments must be excluded. The most probable hypothesis is that the Russian seed is that of a fixed hybrid which, owing to its acclimatization in a new country, has split up into its 2 ancestral forms. Further, many of the plants grow slender and low, with many small concave capitula (that is to say, having their central seeds aborted), so that the total yield was 1918 lbs. per acre as against 4816 lbs. per acre in the case of the 1st generation. On eliminating all the badly grown plants, however, it was calculated that the crop of the 2nd generation amounted to 5867 lbs. per acre. The writer therefore tried to ascertain which of the 3 forms in the 2nd generation eliminated plants gave the highest yield. The results of his research, which are given in the following table, prove the superiority of the type with white seeds, and this he intends to improve by selection.

(1) See B. June 1915, N.º 615.

characters of the 3 forms of sunflower obtained from spotted seed imported from Russia.

	White seeds	Black seeds	Spotted seeds
1. Height of plants in.	122.05	113.1	110.24
2. Diameter of stems in.	1.03	1.54	1.54
3. Diameter of heads in.	13.78	13.98	11.81
4. Diameter of seeds mms.	5.3, 7.8, 11.8	4.8, 7.2, 12.0	4.1, 7.2, 11
5. Weight of seeds per capitulum . . oz.	11.0	11.0	8.0
6. No. of seeds per capitulum	2,100.0	2,342.0	1,484.0
7. Weight of 1,000 seeds oz.	5.20	5.0	4.0
8. Volume of 1,000 seeds cu. in.	24.0	24.0	20.0
9. Specific gravity lbs.	11.140.0	11.603.0	11.282.0
10. Yield of 100 grms. of seed %	16.833	21.41	21.000
11. Oil per acre lbs.	2,204.0	3,850.0	3,200.0

11. **The Tannin Contents of some Queensland Barks.** BRENNER, J. C. and J. D. JERVIS. "T." in *Queensland Agricultural Journal*, New Series, Vol. V, Part 2, pp. 104-109 (Brisbane, February 1919).

CROPS
YIELDING OIL
DYES
AND TANNINS

With the view of commencing a general survey of Queensland barks, the writers have analyzed a number, particularly from those woods which are valuable for timber, as a valuable by-product of the timber industry might be saved and utilised, should the bark of such be found to contain appreciable percentages of tannin. These results are tabulated in three divisions: 1) Barks containing over 20 per cent of tannin: such should have great value as tanning material; 2) Barks containing between 10 per cent and 20 per cent of tannin: these might become of value for the making of extracts, particularly where the bark occurs on large trees which are felled for timber; 3) Barks containing under 10 per cent of tannin: these are probably valueless, though some of the higher ones might be of use for extracts.

As regards Acacias, *A. implexa* is rich in tannin and should be of value. *Brigalow* (*A. harpophylla*) is of considerable interest, being widely distributed throughout the near West and common on the pear-infested land of Queensland. It is used locally for tanning purposes, especially the inner bark. "Tallow-wood" (*Eucalyptus microcorys*) is a coastal tree, but is becoming rather scarce. "White" or "Scrub gum" (*E. haemastoma*) occurs on poor dry ridges in the South Coast districts of Queensland, and is used solely for fencing and firewood. "Gympie Messmate" (*E. Clacziana*), occurs fairly abundantly in the neighbourhood of Gympie. The tree is large

and yields a useful hardwood. Though the bark as a whole is rich in tannin, the inside bark, which is approximately one-half the thickness, contains considerable over 20 per cent, and might be of considerable value. The following are some analyses of samples collected:

Botanical name	Local name	Per cent moisture	Per cent soluble matter	Per cent tannin
Over 20 per cent tannin:				
<i>Acacia</i> sp. (undetermined)	Black Wattle	9.38	34.60	27.22
<i>A. implexa</i>		6.50	30.40	28.22
<i>Eucalyptus (Coccinea)</i> (inside bark)	Gympie Messmate	7.42	31.50	29.02
Over 10 per cent tannin:				
<i>Acacia Cunninghamhamii</i>		3.05	22.08	15.66
<i>A. arundinacea</i>		5.50	25.75	18.42
<i>A. nerifolia</i>		5.15	22.05	11.60
<i>A. horpophylla</i>	Brigalow	5.24	30.24	14.19
<i>Eucalyptus punctulata</i>		10.35	23.16	18.63
<i>E. microcarpa</i>		8.13	29.14	11.78
<i>E. hamatoloma</i>		9.45	21.92	16.60
<i>E. Coccinea</i> (whole bark)	Gum topped Ironbark	6.30	18.55	6.40
<i>Alphitonia excelsa</i>	Red Ash	8.00	15.62	14.12
Under 10 per cent tannin:				
<i>Acacia</i> sp.	Scrub Wattle	—	—	—
<i>Eucalyptus maculata</i>		—	—	—
<i>Eucalyptus</i> sp.	Ironbark	—	—	—
<i>Podocarpus podocaulata</i>	Black Pine	—	—	—
<i>Cardwellia sublimis</i>	Bull Oak	—	—	—
<i>Ficinia</i> sp.	Scrub mahogany	—	—	—
<i>Flacocarpus grandis</i>	Quondong	—	—	—

Blue Gum (*Eucalyptus tereticornis*), *Callitris Parlatorei*, Turpent (Tristania suaveolens), Crowfoot Elm (*Tarrietia argyrodendron*), Red Oak (*Casuarina Cunninghamiana*), Kurragong (*Sterculia* sp.), Red Box (*Flindersia Chalcasiana*) and Tallow wood contain from 4.0 to 4.9 per cent of tannin; Narrow-leaf Wattle (*Acacia* sp.), *Eucalyptus acmenoides*, Blackwood (*E. corymbosa*), Yellow String Bark (*E. eugenioides*), Scented Gum (*E. citriodora*), Sarsaparilla, Sassafras (*Daphnandra aromatica*) from 3.64 per cent; Bally Gum (*Litsea ferruginea*), White Silky Oak, Can nut (*Aleurites moluccana*), White Cedar (*Melia composita*), Black Wattle (*Cryptocarya Palmerstonii*), Jimmy-Jimmy (*Amoora nitidula*) from 2.8 to 2.8 per cent, etc.

Manurial Experiments with Young Rubber at Kuala Lumpur F. M. S. by F. G. (Agriculturist) in *The Vegetation Bulletin of the Federated Malay States*, vol. IV, No. 4, pp. 105-110, Kuala Lumpur, January 1930.

RUBBER,
GUM AND ROSIN
PLANTS

These experiments have now been continued for a period of 4 years during which period the effect of the treatment has been estimated in terms of increase in girth of the trees. As these trees have now reached tapping stage the next years results will be based on yields of rubber.

The manures were applied in circles round the trees and lightly raked in. Quicklime was used in each case and allowed to slake naturally before spreading. The lime and basic slag was always applied several weeks before the other manures. The number of trees in each plot was 10 at the beginning of the experiment but was finally reduced to two. The scheme of manuring and summary of results is as follows.

Plots	Total increase during 4 years	Twice increase in girth					Total increase during 4 years
		over control	control 2nd year	plots 3rd year	4th year	control during 4 years	
	inches	inches	inches	inches	inches	inches	
Rate of ammonia and lime	23.66	1.76	0.19	0.48	0.12	2.55	
Rate of ammonia; sulphate of potash and lime	21.58	1.24	0.04	0.51	1.00	0.81	
Rate of ammonia; double superphosph. lime	23.21	1.87	0.28	1.06	1.44	2.61	
Rate of superphosphate; sulphate of potash and lime	22.14	1.8	0.21	0.84	1.21	1.47	
Rate of ammonia; double superphosphate; sulphate of potash; lime	21.28	1.35	0.04	1.54	0.44	0.91	
Rate of ammonia; double superphosphate; sulphate of potash; lime	22.22	1.08	0.58	0.30	0.31	1.08	
Rate of potash; lime	22.55	1.12	0.21	0.20	0.48	1.18	
Rate of superphosphate; lime	22.08	1.87	0.20	0.10	0.13	1.51	
Rate of ammonia; double superphosphate; sulphate of potash	22.80	1.48	0.15	0.30	0.53	1.66	
Control	21.04						
		No Manured manure applied		No Manured manure applied			

The quantities of manure applied per tree were as follows: sulphate of ammonia $\frac{1}{2}$ lb; sulphate of potash 1 lb; double superphosphate $1\frac{1}{2}$ lbs; lime 1000 lbs per acre.

Reviewing the results of the 4 years it is noticeable that during the first

year, the trees in the manured plots in every case showed a good average girth measurements over the trees in the manured plots. In the second year there was no manure applied when the average girth increase was equal to that of the control plot, showing that the effect of the manure did not continue beyond the first year. At the beginning of the third year a second application of manure was applied but the effect as measured by increase in girth was less than that observed with the first application. In the fourth year when no manures were applied the plots previously manured showed a distinct falling off in girth increase as compared with the manured plots.

In these experiments the manures only had a stimulating effect in the first year of application, followed by a slight reaction. It will be interesting to learn to what extent the fertilisers have been profitable, as shown by yields of latex during the present year.

523. **Manurial Experiments on Sugar Cane, 1914-1915.** — VERTUELL, J. (a Scientist of Field Experiments) in *Bulletin of the Department of Agriculture, Trinidad*, Vol. XIV, Part 5, pp. 143-155. Trinidad, 1915.

Each experiment was made on eight equal plots similarly treated, and the result given for each plot is the mean of eight experiments. This refers to the first ratoon crop.

The manures applied were as follows :

	Plant canes per acre	First ratoon per acre
Plot 1.	Complete manure : 45 lb. nitrogen as calcium nitrate. 40 " phosphates as dissolved bones. 25 " potash as sulphate of potash.	45 lb. nitrogen as calcium nitrate.
Plot 2.	Complete manure : as above but N. from sodium nitrate.	45 lb. nitrogen as sodium nitrate.
Plot 3.	Complete manure : as above but N. from calcium cyanamide.	45 lb. nitrogen as calcium cyanamide.
Plot 4.	Complete manure : as above, but N. from sulphate of ammonia.	45 lb. nitrogen as sulphate of ammonia.
Plot 5.	Complete manure : 45 lb. nitrogen as sulphate of ammonia. 40 lb. phosphates as dissolved bones.	ditto
Plot 6.	45 lb. nitrogen as sulphate of ammonia 40 lb. potash as sulphate of potash.	ditto
Plot 7.	45 lb. nitrogen as sulphate of ammonia.	ditto
Plot 8.	Control. — no manure.	Control. — no manure.

The rainfall during the year was 53.82, 51.51 and 63.43 inches : the three estates on which the experiments were carried out. The manures

SUGAR CROPS

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Field.	Besting Cane, 1890.				Experiment 1, 1891.				Experiment 2, 1891.			
	Manure complete applied to plant cane and First Ratoon.		Nitrogenous manure to First Ratoon.		Nitrogenous manure to First Ratoon only.		Average of Plant cane and First Ratoon.		Nitrogenous manure to First Ratoon.		Average of Plant cane and First Ratoon.	
	Yield, tons.	Increase or decrease of Cane, tons.	Yield, tons.	Increase or decrease of Cane, tons.	Yield, tons.	Increase or decrease, tons.	Yield, tons.	Increase or decrease, tons.	Yield, tons.	Increase or decrease, tons.	Yield, tons.	Increase or decrease, tons.
1	50.89	+ 2.51	10.07	+ 3.59	31.14	+ 8.56	27.75	7.85	26.65	+ 6.67	22.28	1.79
2	43.03	+ 5.65	11.76	+ 4.38	31.78	+ 8.60	28.78	6.88	22.51	+ 2.58	23.91	+ 2.16
3	38.00	+ 1.52	10.18	+ 3.10	28.66	+ 6.18	27.05	1.5	21.00	+ 1.01	23.87	+ 2.29
4	12.54	+ 5.19	12.03	+ 5.55	6.12	+ 7.54	21.6	1.16	22.82	+ 2.86	23.29	+ 1.71
5	35.00	+ 7.62	11.80	+ 3.68	29.71	+ 6.86	27.85	1.95	22.04	+ 2.65	26.37	+ 1.21
6	38.69	+ 1.23	11.31	+ 7.05	28.23	+ 5.95	22.68	2.08	21.90	+ 1.94	21.89	+ 0.11
7	30.01	+ 2.89	8.04	+ 2.30	21.86	+ 5.95	23.16	25	19.64	+ 3.62	26.64	+ 6.65
8, 9th Ratoon	37.68	—	8.758	—	22.88	—	19.6	—	19.75	—	21.55	—

were applied in June 1914 and July 1914, while the canes were harvested in March, April and June 1915.

The value of the canes was calculated on a basis of 1912 and 1913 prices. At the former price several plots show a loss, whereas these same plots show a profit when valued at the higher price.

In one series, the mixed manures were applied to both plant canes and ratoons but without any obvious benefit, better results being obtained by the plots only having applications of single manures applied to the ratoon crop.

The plots receiving sulphate of ammonia were, as a rule, the most satisfactory. The general indications of these results are that nitrate is more efficient than ammonia or cyanamide and that sodium nitrate is superior to calcium nitrate when applied alone to ratoons, but inferior to complete manure.

Ammonium salts are profitable when applied in conjunction with phosphates and potash or with phosphates alone, but not when applied with potash alone.

521. The Acclimatisation of Plants and Their Adaptation to the Soil by Grafting DREZEAU, J. B. in *Revue horticole*, Year 88, No. 3, pp. 17-19, Paris, March 16, 1908.

By means of grafting new horticultural species upon others that are hardy, or already acclimatised, it has often been possible to introduce a plant where the soil is not suited to their requirements. Thus while 20 years ago, the cultivation of *Acacia dealbata* was a monopoly of the Cannes districts (where the soil consists of granite and mica-schists) this plant did not grow well in the rest of the Côte d'Azur (where the soil is more or less calcareous) this variety of *Acacia* can now practically be grown throughout the latter region, if it is grafted on *A. floribunda*. The latter has also been adopted as a stock for *A. podalyriaefolia*, *A. Baileyana*, *A. Goureauxii*, *A. pubescens*, and their varieties. From the economic point of view the cultivation of all these acacias has become most important.

On the basis of these principles, the writer has made some experiments in adaptation by grafting; the following gave him complete satisfaction:

1) *Macadamia ternata*, *Hackea cuneifolia* and *H. pinnatifida* on *Grevillia robusta*. The last species is a valuable stock on which are used: *Grevillia asplenifolia*, *G. Preissii*, *G. Banksii*, *G. Hillii*, *G. Drummondii*, *G. rosmarinifolia*, *G. alpestris*, *G. macrostylis*, *G. sulfurea*; it does well on calcareous soils, except when these are damp and drained.

2) *Araucaria Bidevillii* on *A. excelsa*.

3) *Ficus Roxburghii* and *F. australis variegata* on *F. rubra*.

4) *Raphiolepis Delacourii* on *Cydonia vulgaris*.

5) *Raphiolepis indica* on *Eriobotrya japonica*.

6) *Callitris australis* (calophobe) as well as *Juniperus horizontalis* and its varieties: *conspicua*, *ericoidea*, *elegantissima*, on *Cypripedium*.

7) *Taxonia* on *Passiflora caerulea*, and still better, on *P. flammans*.

8) *Bougainvillea brasiliensis* on *B. Sanderiana*.

grafting *Cactaceae* on certain species of the same genus produces not the collar.

Species of *Iris* possessing rhizomes can be grafted on one another, for example *Iris germanica* on *I. pallida*. A fact worthy of note is, that while these grafts have succeeded in the case of different species, the grafting of nearly related plants such as that of *Eucalyptus foefolia* on *E. globulus*, *Pyanthema* and *E. cosmophylla* gave negative results.

9. The Blooming Season, Ripening Dates and Length of Season for Hardy Fruits.

EDWARD C. P. in *New York Agricultural Experiment Station Bulletin* N. Y. Publication No. 197 and 408, pp. 307-309, 302-108. Geneva, June 1-15.

I. — *The Blooming Season of Hardy Fruits.* — The above mentioned bulletin indicates a blooming season from observations extending over many years at the New York Agricultural Experiment Station, Geneva, for all varieties of fruits commonly cultivated in the State of New York.

This list allows: 1) the elimination of early blooming varieties where late frosts are to be feared; 2) the interplanting for cross-pollination of varieties blooming at the same time; 3) the determination of the date of spraying; 4) the selection of varieties blooming at different times when it is desirable to prolong the spraying season.

A considerable amount of work in cross-pollination at this Station has led to the general observation that very warm weather leads to a more rapid development of the stamen than of the pistil. Not infrequently, in excessively hot weather, it will be found that the stamens have developed much more rapidly than the pistils — that the anthers have burst and shed their pollen before the stigmas are receptive. On the other hand, the pistils develop least rapidly in cold weather. This perhaps explains why, even when the trees blossom well, there is uncertainty as regards the setting of the fruits. Rain during blossoming time is a frequent cause of a poor setting of fruit as it causes the pollen grains of practically all fruit trees to swell and burst. The writer gives as typical blooming dates those he observed in 1912 (an average year). These dates correspond very nearly to the average blooming dates observed in the other years. The typical dates of the beginning of the blooming season, its duration (the interval between the appearance of the first and the last flowers) and the numbers of varieties of each species mentioned in the bulletin in question are set forth in the accompanying table. In this list, the blooming season of each variety is distinguished as: very early, early, mid-season, late or very late.

II. — *Ripening Dates and Length of Season for Hardy Fruits.* — The observations on this subject refer to the same varieties of fruits as those set forth in the preceding paper and to the same years. It has thus been possible to solve the question as to the existence of a correlation between blooming time and ripening time; the answer is negative. The date of maturity is given in the case of each kind of fruit, and the number of weeks the fruits can be kept in the common storage.

The Station where these observations were made is in N. latitude 42° 52' 16"; the altitude is from 500 to 525 feet above sea level. The

	Date of blooming	Duration of blooming in days	No. of flowers
Cherries	May 1	6	35
Pears	" 2	10	12
<i>Prunus domestica</i>	" 3		8
<i>P. ussuriica</i>	" 3	10	11
<i>P. cerasifera</i>	" 3		11
<i>P. triflora</i>	" 3	4 - 8	11
Hybrid Plums	" 3	7	11
Currants	" 3	8	11
Apples	" 4	12	11
Sour cherries	" 4	8	18
Hybrid cherries	" 4	8	11
Goosecherries	" 4	10	51
Peaches	" 5	10	21
Crab apples	" 6	8 - 10	22
<i>Prunus Mauseniana</i>	" 7		5
<i>P. americana</i>	" 7		8
<i>P. hortulana</i>	" 7	11	
<i>P. hortulana Minor</i>	" 7		
<i>P. americana mollis</i>	" 7		1
Strawberries	" 10	17	13
Blackberries	" 31	24	21
Black raspberries	" 31	7	10
Red raspberries	June 1		
Hybrid raspberries	" 7	14	18
Yellow raspberries	" 11		
Grapes	" 14	20	240

land lies about 1 mile from Seneca lake and the soil is a cold heavy clay. The proximity of the lake and the coldness of the soil no doubt delay the ripening time by several days.

526 - **Dwarf Apples.** - HEDGECOCK U. P., *New York Agricultural Experiment Station*, N. Y., *Bulletin* N. 400, pp. 341-368, Geneva, N. Y., May 1915.

At the request of the horticultural societies of the State, the New York Agricultural Experiment Station of Geneva undertook a comparative test of dwarf and standard apple trees. This bulletin is a final report of the test, which was carried on for ten years.

For the standard trees, French Crab stock were used, and for the dwarfs, Doucin and French Paradise stock.

Sites for the tests were selected with reference to climate and soil in widely separated parts of the State as follows: Kinderhook, Columbia County, in the Hudson Valley; Fayetteville, Onondaga County, in central New York; and Carlton, Orleans County, on the shores of Lake Ontario, in western New York.

The general plan of the test was to grow a permanent orchard of standard trees with fillers on Doncin stock and between these, trees on Paradise stock. The orchards were set with 27 varieties represented by 1103 trees; 424 were on French Crab, 424 on Doncin and 655 on Paradise stocks.

The care taken of the orchards was that commonly given commercial orchards in New York except in the matter of pruning. Summer pruning is part of the recognized early treatment of dwarf trees. In this ten years' test no satisfactory time nor method could be found to prune these trees which did not promote a weak, sickly growth. The branches invariably died back the next winter.

The results show:

1. That the union between stock and scion is poorer with Doncin than with French Paradise stocks than with the French Crab, and that varieties grow less well on French Paradise than on Doncin stocks.

2. Doncin and French Paradise stocks are less hardy than French Crab, and of the two dwarfs French Paradise is much less hardy.

3. The greatest weakness of the dwarfing stock for New York is the false-rooting habit, in which character the two stocks cannot be distinguished. Evil results following surface rooting are winter-killing, uprooting of trees by wind, suckering and injury in cultivation.

4. Suckers from both dwarfing stocks proved much more troublesome than with the standard trees.

5. The trees on the three stocks attain the size commonly ascribed to them; those on French Crab are full-sized; on Doncin, half dwarf; on French Paradise, true dwarfs. In this test the dwarfing effect of the dwarf stock was not as marked as is commonly reputed. The writer concludes that distances apart commonly recommended for dwarf trees bring them much too close; in New York, Doncins should be set half, and the true dwarfs one-third, as far apart as standard trees. That is, apples on Paradise should be planted from 15 to 18 ft. apart; on Doncin 20 to 25 ft. apart. If the scion is permitted to strike root, greater distances must be allowed.

6. Trees on French Paradise come in bearing soonest, Doncin next and French Crab last. The differences in time of bearing would not be very material in commercial orchards.

7. The test has not been such that a safe conclusion can be drawn as to which stock makes the most productive orchard.

8. There were no marked differences in size, colour and quality of apples of the three stocks.

9. The advantages of dwarf trees appeal to amateur rather than professional apple growers. Thus, the trees take less space and therefore admit a greater variety in orchard or garden and they are more hand-someamentals.

527 - Experiments in Manuring Vines with Chemical Fertilisers, Carried out in 1915 by the National Society of Agriculturists of Hungary. — KOVÁCS B., *hazaisági Szemle*, Year XXXIV, No. 2, pp. 66-69, 4 Illustr. Budapest, February, 1915.
 U. *Die Ernährung der Pflanze*, Year XII, No. 5, pp. 37-39. Berlin, March 1, 1915.

In spite of the large amount of damage (due to frost, mildew and hail), done to the vines during the last 3 years, the National Society of the Agriculturists of Hungary continued in 1915, their manurial experiments upon the vines of the different vinegrowing districts of the country. In this work they were assisted by 18 proprietors of vineyards. The results, however, which are summarised in the following table, represent the data obtained by 10 vine-growers, for the 8 others were unable to finish their experiments on account of unfavourable weather conditions. The experiments were made on the most characteristic soils of the country (namely those of the mountainous zones, and on the sandy soils) in the districts of Pest-Nograd — Ménés-Magyarád — Gyöngyös-Visont — the Alföld — Villány — Pécs — Tokaj — Küküllő — Bácsosony — Nagyménly. In order to decide upon the amounts of chemical fertilisers to be used, the observations of the Royal Hungarian Vine-growing Institute were taken as a basis, according to which a large increase in the yield could only be obtained by using larger quantities than had hitherto been employed. Thus, 465 lbs. of superphosphate, 155 lbs. of 40 per cent potassic salt and 231 lbs. of sulphate of ammonia were applied per acre.

On examining the results, it is seen that No. 5 gave the maximum returns, which is the more surprising since this vineyard received no sulphate of ammonia. The higher yields must be attributed to more careful cultivation operations, and to the fact that the vineyard of Pécs being situated at the foot of a hill and having a soil which is rich in humus and nitrogen, does not require nitrogenous fertilisers. The fertilisers have a great effect upon sugar formation, in fact all the manured vineyards had a higher sugar percentage than the control plots. The increase in the sugar content due to the use of the fertilisers was from 1 to 3 per cent.

The following conclusions can be drawn:

1) Chemical fertilisers considerably increase the yield, even on heavy soils, provided the vineyards are not injured by bad weather or the attack of various pests.

2) In vineyards situated on various soils, even in very heavy ones the 3 fertilisers should be applied in very large quantities, as the amounts hitherto used of from 154 to 300 lbs. per acre, are unable to penetrate to the deeply-seated roots, and thus it is not possible for the fertilisers to produce an increase in the yield. An exclusively phosphorus-nitrogenous fertiliser does not give the best result, which can only be obtained by the help of all three fertilising compounds.

3) The fertilisers should be dug in very deep, the phosphatic and the potassic fertilisers being applied together in the autumn if possible and the nitrogenous fertiliser in the spring.

4) Chemical fertilisers gave the best results from the first year of their use in those vineyards which had previously received a liberal amount of stable manure. In such vineyards, there is a strong development

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Table 1. *Material and Labor Costs*

Number	Variety and Name of soil	Age of vines (years)	No. of vines per acre	Vines	Amount of Fertilizers used, lbs. per acre	Substance of phosphate super-	Percentage of Sugar	Yield of fruit,		Value of Increase, per acre	Cost of manure	Profit, due to manure		Value per gal. of must										
								With manure	Without manure			d	s		d	s								
1	Perez . . . compact clay	6	3,376	Exhib.	100	155	232	18	16	270.09	151.35	124.64	14	3	3	2	5	11	5	5	2	3		
2	Opalus . . . diolite	15	2,954	vulcan	406	155	232	20	19	186.06	121.64	62.32	7	1	8	3	12	2	3	10	6	2	3	
3	Oxygys . . . humiferous	10	2,672	Exhib.	406	155	—	16	13	168.16	107.13	80.03	10	2	4	1	7	4	8	15	0	2	3	
4	Nyng-Laza-sandy . . . clay	14	3,808	Rising	100	155	—	18	18	50.79	55.08	17.80	2	0	6	1	7	1	0	8	5	2	3	
5	Pege . . . clay	10	3,808	Humid.	535	232	—	21	18	111.27	275.05	347.21	78.18	1	2	8	77	7	4	4	0	2	2	
6	Taread . . . compact clay	10	4,219	Humid.	400	155	—	21	21	180.06	151.05	15.61	6	16	0	1	7	4	5	7	2	5	0	2
7	Vine . . . compact clay	18	3,727	Rising	406	155	232	19	16	97.62	83.88	13.54	15	3	6	1	11	2	11	12	4	2	3	
8	Carb . . . clay	10	5,020	Exhib.	406	155	—	18	18	67.02	73.84	231.47	26	6	1	1	7	4	11	12	2	2	3	
9	Mer . . . clay	10	5,020	—	400	155	232	19.5	18	32.82	231.47	151.5	17	4	0	1	11	2	13	12	10	2	3	
10	Amor . . . clay	7	2,813	vulcan	406	155	232	—	—	62.21	311.60	311.60	15	3	3	11	2	17	1	2	3	3	3	

vigorous roots; in vineyards with superficial, weak and exhausted soils the fertilising effect of the chemical manures only shows itself after the repeated application of the fertilisers, that is to say, not until they have regained their strength.

5) Chemical fertilisers hasten the ripening of the grapes, and increase their sugar content.

528 - **Hybrid Direct Bearers in the Plain of Pisa, Italy.** - RACCHI VICTORIO, *La Agricoltura*, Year 53, No. 3, pp. 122-128, 4 figs., Piacenza, March 15, 1916.

The writer first mentions the origin of hybrid direct bearers, the results on crossing and the ideas they inspired, subsequently describing the best hybrid direct bearers which he has seen in the vineyards of Sig. Sestini (San Frediano a Settimo, plain of Pisa), where there is a collection of 100-200 hybrids and where 20 are grown on a large scale. Of these, the following appeared the best:

Seibel: 1, 2, 47, 60, 128, 405, 857, 1000, 1077; 28-50 - Castel 114; Coudere 7120, 106-46, 272-60 - Gaillard 2.

The writer advises the use of the following: for long pruning: Seibel 1, 1000, 1077 - Gaillard 2. For growing short, with close or mixed pruning: Coudere 7120, 106-46 - Seibel, 1 and 2.

In localities that are damp and subject to fogs, very subject to fungoid disease: a) with black grapes: Seibel 1, 2, 47, 1077 - Gaillard 2; b) with white grapes: Seibel 857 - Castel 114 - Coudere 272-60 - Gaillard rose coloured grapes: Seibel 28-50.

The writer is of opinion that in damp, deep, fertile soils (e.g. in Tuscany, those of Pisa, Valdichiana, and Val d'Arno; in N. Italy, those of the plain of Padua, where vines are grown producing heavy crops and giving wines usually possessing little colour, and of low alcohol content), the quality of the wine would undoubtedly be greatly improved by substituting, in whole or partially, 1 or 2 good varieties of hybrids for the vines producing grapes of inferior quality.

529 - **Hybrid Direct Bearers in Friuli, Italy.** - COCCANI, R. in *Bollettino dell'Ente Nazionale per la Coltura della Vite e del Vino*, Vol. 11, No. 1, pp. 166-178, Udine, Dec. 1915.

Observations made in the experiment vineyard of the Friulian Antiphylloxera Consortium of Gagliano (Comune of Cividale, Province of Udine) on average soil, with gravel subsoil, and situated in a dry, open district. These conditions are those usually obtaining in the vineyards of the Friuli plain. The soil of the vineyard which was the subject of the experiment contained 7.2 per cent of lime; the vineyard was composed of the following 63 vines coming from State nurseries in the Tremiti Islands:

Alicante Ganzin - Alicante Terras No. 20 - Auxerrois Repest - Castel 120, 1028, 3015, 3017, 4233, 4327, 5009, 6011, 6030, 6228, 6229, 7214, 9137, 10010, 13317, 13320, 17033, 17227, 10403, 20418 - Coudere 28-112, 44-01, 71-06, 71-20, 71-46, 74-17, 82-12, 82-32, 83-3, 63-5, 63-10, 101, 106-46, 124-20, 132-11, 140-51, 108-21, 109-88, 202-137, 224-23, 252-14, 267-27, 272-60, 343-14, 503, 1305, 3007, 43-8 - Fournier 137 - From Jurie 380 - Seibel 1, 2, 128, 150, 417, 857, 2007 - Gaillard 1-17

Almost all the vines did well that were planted out after growing for a year in the nursery; others took root with much difficulty, namely: Alicante Ganzin, Condere 124 130, 168-21, 226-21. Most of them grew satisfactorily; some were of average development (Alicante Ganzin — Auxen, Rapestris — Castel 3915, 3917, 6-11, 9137, 1326 — Condere 82 12, 6-2, 202-137, 343-14); a small number were poorly developed (Castel 4233, 137-10493 — Condere 100-88, 226-21, 282 14).

In the case of each vine, the writer gives the quality of the grapes and the degree of the plant's resistance to fungoid disease and to phylloxera. He divides the vines into three classes as regards resistance to mildew:

- 1) Immune *i. e.* not requiring to be sprayed.
- 2) With signs of mildew which are not of a serious nature but can be controlled by one spraying in normal years and with 2 in years when mildew is especially prevalent.
- 3) Vines as subject to the disease as the ordinary European varieties, and therefore to be eliminated.

Few vines belong to the 1st class, these are:

Alicante Terras 20 — Castel 1028 4334 5000 17033 — Condere 168 1 and 4308 — Fournié.

The following belong to the 2nd class:

Castel 120, 3915, 3917, 4327, 6011, 6228, 7214, 10010, 13317, 13320, 1227 — Condere 28-112, 93-5, 99-32, 101, 132 11, 140-51, 207-27, 272-60, 3 — 3997. — Jouffreau — Jurie 580 — Sibbel — Condere 503 — Gaillard 12.

Of the vines of these two classes, the Castels 1233 and 1327 and others 93-5 have not yet borne grapes, therefore they cannot be judged on the point of view of their produce. Castel 17033 and Condere 28-112 have phylloxera galls on their leaves. Castel 6228 and 7214, and Fournié, have pronounced foxy flavour. Castel 3915 and 3917, and Condere 1325 are too late; they therefore never attain complete maturity, and are subjected to the danger of the autumn rains. Castel 13317 suffers from the defect of having a large number of green grapes when it is ripe. Condere 1331 is more a table grape, but it has not the requisite qualities. Finally, Castel 5000 (which has a "herby" taste), 10010 (which has a similar flavour), 17227; the Condere 99-32, 101, 132 11, 168-21, 4308 (also with a herby flavour), 503 (which ripens irregularly), Jouffreau, Jurie 580, Castel 1; Gaillard 2 bear black grapes which are too dark to find favour in France, where no wines for blending are made. After having made a selection from all these vines, there only remain 9 out of the 31 of the 2 first classes: 6 with black grapes: Alicante Terras 20 — Castel 120, 13320, 1227 — Condere 207-27, 3917; — 3 with white grapes, Castel 1028, 1011 — Condere 272-60) which at present are the best that have been tested. It is, however, quite possible that further observations may modify or complete this judgment.

LIVE STOCK AND BREEDING.

530 The Experimental Control of Distomatosis in Hungary. — MARCH J. J.

Lajpok (Veterinary Journal), Year XXXIX, Nos. 1 & 3, pp. 116; 117-14; 1 & 2.

January 18-15, 1916.

During the summer of 1913, numerous contagious diseases appeared in Hungary, distomatosis especially, causing serious losses. This, as well as the publications of RALLIET, MORSE and HENRY on the control of this disease, by means of fern extract, have encouraged the writer to make an extensive study of distomatosis and to experiment with curative methods on 65 head of cattle and on 87 head of sheep. Up to date only the experiments with sheep have been completed. The affected animals were periodically examined by the writer and then killed in the public slaughter-house of Budapest to allow of a microscopical and macroscopical examination of the liver and related organs. So far few animals have died during the experiments.

The anatomical changes in the liver corresponded to those already described, except in cases of very numerous invasion, when they were more severe in cattle than in sheep. Another characteristic anomaly which has seldom been noticed before was the following: the left lobe of the liver both in cattle and sheep, was more seriously affected than the right lobe, showing the greater number of flukes. In some milder cases of distomatosis only the left lobe of the liver contained distoma; as a possible explanation of this fact the suggestion is made that this side of the liver might be more easily accessible to the parasites than the other.

In one cow and three sheep, there were found, together with medium-sized distoma, some flukes measuring from 10 to 15 mm. in length without eggs, and others measuring from 5 to 10 mm. in length without eggs.

The number of parasites found in 20 head of cattle which had not been treated with curative remedies, ranged from 116 to 1660.

The greater number of the parasites belonged to the species *Distoma hepaticum*, and only a few to *D. lanceolatum*, which was always found in conjunction with the former. In one exceptional case a sheep showed no less than 888 parasites of the latter type. It has not been ascertained as yet whether the number of *D. lanceolatum* increases in proportion to that of *D. hepaticum*, but this is very likely the case. In animals affected by distomatosis an alteration of the bile was always to be noticed the liquid part being thicker, mucilaginous and of a dirty greenish-brown colour; the solid part being composed of eggs of distoma. The gall bladder was enlarged. The external symptoms of the disease have been noticed only in animals showing at least 250 parasites for cattle, and 100 for sheep. Thus these symptoms only appear when the animals' blood is infected with the flukes to such an extent as to cause emaciation and anaemia in the host. Only one case of dropsy occurred, in a cow. The size of the liver was not abnormally large in 29 head of cattle while in sheep it was always normal.

The diseased cattle rarely suffered from intestinal troubles, but often showed a rise in temperature. The number of fluke eggs in the faeces varied with the consistency of the faeces; it was small in cases of diarrhoea when the rapid widing of the excrement hindered their accumulation, and much larger after fasting owing to the longer retention of the excrement in the intestine. The faeces of the cows generally contained a smaller number of eggs than the ovine faeces. The number of eggs of *S. lagnellatum* in the faeces varied between much wider limits than the number of eggs of *D. hepaticum*.

The writer discusses the results of the experiments made by MOISSY, RANCHARD, VLASZ, MOLPHETAS and others, subsequently describing his own experiments. His first trials with fern extract date from 1912, and were followed by similar experiments with Kamala, and other preparations of the same kind. The experiments on sheep, the only ones completed up to date, gave the following results:

It is possible to control distomatosis in sheep with success by curative methods, especially if the disease has not reached the stage of deep pathological changes of the liver. Medium-strong doses of Kamala give 85% recovery in sheep, while in the remaining 15% the flukes are checked to such an extent that the life of the host is not endangered. The best results are obtained with Kamala. A preparation containing this substance, called "parasitine", is less effective, though the results are fairly good. The preparation called "calbazene" contains too little Kamala to be really effective.

For one year old sheep 15 gms. of Kamala in 2 doses with 6 to 12 hours intervals are required. To strong animals the whole dose may even be given at one time, but in the case of weak animals, or those suffering from diarrhoea, the dose should be increased to 20 gms. and given at 5 intervals. "Parasitine" is administered at the rate of 2 pills in $\frac{1}{2}$ or 1 day intervals.

After taking Kamala the sheep appear to be sick for 4 to 5 days; they lie down, eat little or nothing and suffer from diarrhoea; no other symptoms of the disease are to be seen. Under the influence of Kamala, the flukes die in about 3 to 8 days and are expelled from the bile into the intestine.

The eggs resist the action of Kamala much longer, but in about 8 days they are killed and expelled. The expense of the Kamala treatment is insignificant.

Fern extract (including "fascioline") has been found inefficient as it only destroys, in sheep, one half of the flukes. This failure is due to the varying content of active substances in the ferns according to their habitat, and to the methods used for making the extract. The high toxicity of this extract, which prevents its use for a sufficient length of time, must also be considered. It should therefore only be used when Kamala is not available, and when the extract is known to be sufficiently strong, though even then the results are not certain.

The dose of fern extract for yearlings is 5 gms. and for older animals

6 gms.; it should be spread over 6 consecutive days, mixed with a small quantity of neutral oil.

The fern extract is quite inefficient with cattle, but a dose of a small quantity of "filmaron" may kill some of the flukes if injected percutaneously. This process, however, is not to be recommended in practice for the reasons are rather uncertain, the liquid soon losing its properties.

The excellent results obtained with Kamala on sheep lead to the supposition that it will be equally effective for cattle. The results obtained by the writer apply only to *D. hepaticum* since *D. lanceolatum* was not killed by these methods of control. This is, however, of little consequence because the latter is found only in small numbers and only causes a mild and less dangerous form of distomatosis.

Should the writer's experiments prove that Kamala also destroys the parasites of the liver of cattle it would be possible in future to diminish the cases of disease occurring in animals out at pasture. For such an object the following method should be adopted: all the animals (sheep and cattle) should be treated with Kamala at the beginning of the winter; for the succeeding weeks the dung should be collected and covered with dung on healthy animals in order to kill the fluke ova by the process of decomposition. This should be repeated in the spring just before taking the animals to pasture, so as to kill the few distoma that may have survived the first treatment. If during the pasturing time, cases of distomatosis occur in diseased animals should be isolated and again submitted to the medical treatment. Newly bought animals should also be immediately treated with Kamala unless they are positively known to be free from distomatosis.

531 - **Treatment of Navel-ill by means of Serum derived from the Blood of the Mare**
 FORSSCILL, GEORGE, in *Berliner Tierärztliche Wochenschrift*, Year XXXII, No. 11, pp. 133-135. Berlin, March 25, 1916.

The aetiology of navel-ill in foals has been discussed for a long time. Some veterinary surgeons consider that the infection of the foal from the navel takes place after birth, while others believe it is autogenous. The writer inclines to the latter hypothesis, from the two following facts: 1) that foals, apparently healthy at the moment of birth, may fall sick one, two days or even weeks later; 2) that in the mother no symptoms of the disease are ever seen. The writer has concluded that the blood of the mare must contain certain specific substances which preserve her from the disease and which are also communicated to the foetus. After birth, when these substances can no longer be transmitted to the foal though the common cutaneous arteries, the foal is liable to contract the disease because these specific substances can no longer prevent the disease.

These considerations have suggested to the writer the possibility of curing sick foals by injecting the moment the malady appears, a certain quantity of serum taken from the mother's blood. With this object, he has devised a method of treatment which has been published in the *Scottish Veterinary Review*, 1915, No. 5; and was tested in 1915 by several veterinary surgeons on 8 sick foals, 4 of which were cured. Of the other 4 unsuccessful

per 2 may have been due to the fact that the treatment was applied only 5 and 11 days, respectively, after the disease appeared.

Method of treatment: The blood is drawn by means of a cannula designed by the writer which is sold by Messrs. Jacoby of Stockholm, and is placed in a sterilized glass vessel and after standing a few hours the serum is separated from the solids. From 2 to 2.5 litres of blood should be drawn so as to obtain a sufficient quantity of serum. The injection may be either hypodermically or endovenously in doses of from 500 to 1000 cc. per foal; or 200 cc. may be injected hypodermically and 150 cc. given orally at the same time. If the quantity of serum is sufficient, repetition may be repeated after a few days. The injection should be given immediately the first symptoms of the disease appear. It may be possible to prevent the disease by giving the injections as soon as a foal is born, even if no symptoms are visible.

Modification of Theiler's Method for the Immunisation of Cattle against Piropilosis. SA CARLOS and CUNHA ALEMIDA in *Revista de Veterinária e Zootecnia*, Vol. IV, No. 3, pp. 228-303, 1 Pl., Rio de Janeiro, December 1911.

A summary of the work done up to the present time on "tristeza" (i.e. piropilosis or babesiosis) in Brazil and an account of the immunisation experiments and observations made by the writers followed by bibliography of 25 works.

As a result of their clinical experience, the writers conclude that the injection of trypan-blue by Theiler's method for immunisation against "tristeza", seriously endangers the animals' lives, while early injection of the remedy avoids this danger without detriment to the immunisation process. An early injection of trypan-blue is always preferable to a late one. It should be made at the beginning of the first sign of fever caused by the agent, i.e. as soon as the initial temperature has risen 1°C. By this means even animals of more than 2 years old can be rendered immune without danger.

Plague Attacking Wild Ducks in Milan. COMISOLLE, GUGLIELMO, in the experimental study of infectious diseases of cattle, Milan in *Entomologia e Zoologia*, Vol. XXXIX, No. 3, pp. 130-135, 2 Figs., Milan, March 6, 1912.

Ducks are fairly immune to bird-plague under normal conditions, but in practice this immunity constitutes a valuable diagnostic character which serves to distinguish cholera and plague in the case of infection breaking out and spreading rapidly in a poultry farm. Sometime ago, the wild duck in a section of the lake in the Milan public gardens were attacked, and half their number killed. The writer believes this infection may have been due partly to an exceptional virulence of the virus of the disease (which, as several writers have proved, shows a marked variation in degree of virulence and resistance to disinfectants); and partly to the diminished disease resistance of the wild-duck when in captivity. From a study of the infection the writer draws the following conclusion:

(1) Bird-plague may attack even wild duck when in the same conditions as domestic fowls.

2) The clinical form taken by the plague infection in these cases is the nervous form.

3) The post-mortem examination revealed no pathological peculiarities.

4) The virus, as is also the case with geese, is not present in any infection, either in the blood or the internal organs, but is found only in the central nervous system.

5) The infection can be transmitted to fowls by the subcutaneous inoculation of an emulsion of brains from infected ducks; in the case of domestic ducks, on the contrary, it is not possible to induce infection (however great the quantity of virus) either by ingestion, endovenous inoculation, injection in the membrane of the eye or endocerebral inoculation.

534 **Raising the Dairy Calf.** — WOODWARD, E. G., *The University of Nebraska Experiment Station of Nebraska*, Vol. XXVII, Article VI, Bulletin No. 149, pp. 1-16, 8 figs. 1. Nobr. April 3, 1915.

TABLE I. — *Showing Results of Feeding Three-day Steer Calves Skim Milk up to the Age of One Year.*

Calf	Age days	Whole milk lbs.	Skim milk lbs.	Alfalfa hay lbs.	Grain lbs.	Birth weight lbs.	One year weight lbs.
Jersey	360	258	5 958	1 609	1 178	60*	580
Holstein Jersey.	384	251*	6 366	1 696	1 652	48	750
Grade Holstein	344	245	5 620	1 584	1 238	74	700

* Estimated.

TABLE II. — *Showing Feed Requirement to raise a Calf up to the Age of Six Months when Skim Milk is used.*

Feed	Amount lbs.	Price	Value
Whole milk	175	per cental \$ 1.50 s.	\$ 2.63
Skim milk	2 700	" " 0.25 s.	" 0.68
Grain	125	" " *1.00 s.	" 1.25
Hay	450	per ton "10.00	" 2.25

\$18.83

TABLE III. — *Showing the Feed Requirement to raise a Calf up to the Age of Six Months when a Small Amount of Whole Milk is used.*

Feed	Amount		Price	Value
	lbs.			
Whole milk	9000	per centd \$	1.50	\$13.50
Barley	2500	" "	1.00	" 2.50
Hay	6000	per ton "	10.00	" 60.00
				\$76.00

Rations for Heifers from 6 to 12 Months Old. *Ration I.* — About 2 lbs daily of a mixture of 75 lbs corn chop and 25 lbs bran; all the alfalfa hay the heifer can eat.

Ration II. — 6 to 10 lbs silage; about 2 lbs daily of a mixture of 40 lbs corn chop (entire ground grain), 40 lbs linseed meal or cottonseed meal, and 20 lbs bran; all the alfalfa hay the heifer can eat.

Rations for Heifers One to Two Years Old. *Ration I.* — About 4 lbs of corn daily; all the alfalfa hay the heifer can eat.

Ration III. — Corn silage, 12 to 20 lbs; about 4 lbs daily of a mixture of 2 parts corn chop, bran and linseed meal or cottonseed meal; all the alfalfa hay the heifer can eat.

Effect of Small Quantities of Phosphates Fed to Cows on the Quantity and Quality of the Milk Produced (1). — WALKER FRANK P. in *Report on Experiments in the*

Feeding of Dairy Cows at Orléans Hall, Orléans, Canada, N. B., 1903-1904, New College of Typo., June 1905.

After the manuring of pasture lands with phosphatic manure, the quantity of milk and flesh of the cattle was so much increased that a trial was made in order to determine whether feeding of the cows with a substance (fin phosphate of lime would in any way influence the temperament and nervous system of the animals, and consequently the quantity and quality of their milk. — For this purpose to each of two groups of 5 cows (besides the usual ration, which was the same for all) 1 ounce of phosphate precipitate obtained from bone ashes was given from June 25 to July 30 (1902) to the first group; and from August 6 to September 10 to the second group. The bone ashes contained 70 % of phosphate of lime almost completely soluble in a 2 % solution of citric acid. From the results, the weekly stages of which are given in 9 tables, the following conclusions were drawn:

1) Feeding phosphate precipitate obtained from bone ashes produced no noticeable change in the quantity or quality of the milk. 2) The

conditions of the cows showed nothing out of the normal that might be attributed to any stimulating effect caused by the phosphate they received. 3) The slight effect produced on the quantity and quality of the milk was, if anything, depressing. 4) As regards live weight of the cows that were fed with phosphate showed a tendency to increase weight more rapidly than those that did not receive any phosphate.

536 - **Variations in Interval Between the Two Milking-times and their Influence on the Quantity and Quality of Milk** - WALKER FRANK F. in *Report on the Experiments on the Feeding of Dairy Cows at Ojesteron Hall, Off. of the Bulletin, No. 5, pp. 8-11, N. 1900-Tyler, June, 1915.*

This experiment was carried out during the summer of 1915 for the purpose of determining the influence of a variation in the interval between two successive milkings on the quantity and quality of milk produced. From July 1 to August 11, the cows of one of the two groups of the test were milked twice a day at equal intervals, that is at 6 in the morning and 6 in the afternoon. Those of the other group were also milked twice a day, but at intervals of 14 and 10 hours respectively, that is at 6 in the morning and at 4 in the afternoon. Then, from August 1 to September 22, the cows of the first group were milked at unequal intervals and those of the second group at equal intervals. The food was exactly the same for both groups. Each day the quantity of milk was determined, as well as the fat content, and the solids not fat; these were registered in a table giving the weekly results per cow. The conclusions are: 1) It can be stated that the quantity and quality of milk is in any way influenced by the equal or unequal interval between the two daily milkings; 2) The fat content varies considerably according to the length of the interval between the morning and evening milking; 3) In order to ensure that the fat content of the milk drawn in the morning should be at least equal to that of the milk drawn in the evening, the interval between the two milkings should be as far as possible equal in length; 4) In case of the percentage fat content being established by law for fresh milk sold on the market, the milk would have to be analysed for both milkings, in order to judge of the quality; 5) While the fat content remains about normal in conditions of bad diet, the percentage of solids not-fat may, for those conditions, be sensibly diminished; 6) The cows that were milked at equal intervals yielded more milk in the evening than in the morning. The evening milk was somewhat inferior in quality. The cows that were milked at irregular intervals yielded a richer milk in the evening than in the morning.

537 - **Maize Silage and Alfalfa Hay for Beef Production.** - BLISS R. K. and HALL C. in *The University of Nebraska, Bulletin of the Agricultural Experiment Station at Lincoln, Bulletin No. 151, 13 pp., 16 figs. Lincoln, Nebr., May 15, 1915.*

The economy of silage in the ration of the dairy cow has been proved by many experiments in recent years. In the fattening of steers there is much fewer experimental data, some of which seem to be conflicting. The two experiments recorded in the present bulletin were inaugurated largely for the purpose of securing information on this subject. The first experi-

was carried on during the winter of 1912-13 with 48 head of two-year-old steers of the Shorthorn and Hereford breeds; the second experiment was carried on during the winter of 1913-14 with 64 head of the same age and breeds as the steers used in the previous test.

Steers used; 1st experiment.

- 1. 12 — Ground maize, cold pressed cottonseed cake and prairie hay.
- 2. 12 — Ground maize, corn silage, and cold pressed cottonseed cake.
- 3. 12 — Ground maize, corn silage and prairie hay.
- 4. 12 — Ground maize, a heavy feed of maize silage and alfalfa hay.
- 5. 12 — Ground maize, a medium feed of maize silage and alfalfa hay.
- 6. 12 — Maize and alfalfa hay.

In addition to the feed mentioned each steer received 1 lb of oat straw per day.

2nd experiment.

- 1. 12 — Ground maize and alfalfa hay.
- 2. 12 — Ground maize, alfalfa hay, and wheat straw.
- 3. 12 — Ground maize, alfalfa hay, and a light feed of silage.
- 4. 12 — Ground maize, a medium feed of silage and alfalfa hay.
- 5. 12 — Ground maize, a heavy feed of silage and alfalfa hay.
- 6. 12 — Ground maize, alfalfa hay, and a heavy feed of silage at the beginning, which was changed to a light feed at the close of the feeding period.
- 7. 12 — Ground maize, alfalfa hay, a medium feed of silage and cold pressed cottonseed

cake. — Ground maize, a heavy feed of silage, cold pressed cottonseed cake and alfalfa during the first five weeks.

All of steers, excepting those in lot 2, received 1 lb of wheat straw per day.

Cost of feeds; 1st experiment:

	\$
Ground maize, per bushel	1.00
Cold pressed cottonseed cake, per ton	15.00
Alfalfa hay per ton	10.00
Prairie hay per ton	6.00
Maize silage per ton	1.00
Oat straw per ton	1.00

2nd experiment:

Ground maize, per bushel	1.00
Alfalfa hay, per ton	10.00
Maize silage, per ton	1.00
Cold pressed cottonseed cake, per ton	15.00
Wheat straw, per ton	1.00

The following tables give the results of the experiments. In the second experiment all of the steers except those in lot 3 were fed at a loss; this can largely be traced to two causes: to the rather small margin between the buying and selling prices of the steers and to the high price paid for maize.

Results of the First Experiment.

Lot	Number of steers in lot						
	1	2	3	4	5	6	7
Average first weight per steer	944.00	930.00	910.00	975.00	985.00	945.00	
Average last weight per steer	1,247.00	1,254.00	1,191.00	1,327.00	1,305.00	1,305.00	
Total gain per steer	303.00	324.00	281.00	352.00	320.00	360.00	
Average daily gain	1.03	2.01	1.75	2.24	2.04	2.29	
<i>Total feed consumed:</i>							
Maize	22,643.26	18,351.05	20,270.75	19,001.15	17,106.00	19,477.06	
Prairie hay	5,079.50	—	1,101.75	—	—	—	
Cold pressed cottonseed cake	3,409.57	3,357.36	—	—	—	—	
Straw	—	1,256.00	1,256.00	1,256.00	1,090.00	1,699.00	
Maize silage	1,256.00	—	20,740.50	35,755.50	18,200.00	—	
Alfalfa	—	35,934.50	—	6,331.00	6,798.00	8,408.50	
<i>Feed required for two lbs. gain:</i>							
Maize	931.12	728.00	922.00	677.00	774.72	772.90	
Prairie hay	209.55	—	186.30	—	—	—	
Cold pressed cottonseed cake	140.66	131.40	—	—	—	—	
Straw	51.82	19.85	57.10	41.60	18.91	43.61	
Maize silage	—	1,426.00	941.00	1,103.21	813.97	—	
Alfalfa	—	—	—	221.82	302.50	337.24	
<i>Cost of two lbs. gain:</i>							
Average cost per steer	0.51	0.29	0.68	0.79	0.81	0.72	
Initial cost	59.00	58.60	57.41	60.04	61.50	50.06	
Cost of feed	28.82	29.26	24.67	27.42	26.68	25.00	
Cost of marketing	3.12	3.11	2.99	3.22	3.27	3.20	
<i>Total</i>							
Average price received per steer	99.04	94.09	85.40	94.00	94.54	88.41	
Cost per lb. of gain	100.50	68.40	104.32	100.48	100.00	100.00	
	0.12	—	0.22	0.11	0.11	0.11	

CATTLE

[illegible]

Conclusions. — A ration of maize and alfalfa hay produced the largest gains of any ration used. Furthermore, the steers fed maize and alfalfa hay made as rapid gains as did the steers on any other ration.

Cold pressed cottonseed cake did not give as good results, as either rate of gain or economy of gain, as did alfalfa hay in a ration for fattening steers.

The addition of cold pressed cottonseed cake to a ration of maize, silage and alfalfa increased the cost of gain and lowered the profits on the steers.

The steers receiving silage without exception shed their coats early in the spring and at all times presented a sleek and sappy appearance.

Contrary to preceeding experiments, a heavy feed of silage with alfalfa hay and maize gave as rapid gains as did either a medium or a light feed of silage with alfalfa hay and maize. The amount of silage which could be fed to fattening steers apparently must be regarded as unsettled.

The steers fed silage in connection with maize and alfalfa suffered only slight shrinkage when shipped to market. Different amounts of silage seemingly had no effect upon the number of pounds shrinkage.

Where prairie hay was used in place of alfalfa, small and expensive gains resulted.

The individuality of a steer is a very important factor in the rate of gain. The average difference in gains made between the highest and lowest producing steer in each of 14 different lots was 120 lbs. In practically all cases there was a greater variation in the daily gains made by steers in the same lot than there was in the average daily gains of the different lots.

An advance of 8 cents per bushel in the price of maize increased the cost of gains \$ 1 per 100 lbs.

In the second experiment, where a ration of maize and alfalfa hay was fed, an increase of 1 cent per bushel in the price of maize had the same effect in increasing the cost of gains as did an increase of \$ 1 per ton in the price of alfalfa hay.

535 **Improvement of Italian Sheep** (1). — MASCHERONI E., in *L'Industria (Agricola)*, Year XIV, No. 3, pp. 35-40, Fig. 1, Reggio Emilia, February 1, 1910.

In order to improve Italian sheep, especially in Tuscany, the Abruzzi, Latium, most of the southern provinces and Sicily, several crosses with foreign breeds have been made with Spanish, Châtillon, and Rambouillet Merinos. The results may be considered good, for without affecting the milk production the weight of the sheep increased and the quality of the wool was finer, more silky, stronger and more abundant. A cross was also attempted between Australian Merinos and Italian "Visone" and "Sopravissane" sheep; also with Cotswold, Oxford, Southdown, New Kent and Leicester rams mated with south Italian breeds, but the results were not encouraging perhaps because the experiments were isolated and on no general plan.

As regards the measures advisable for the improvement of sheep:

(1) See B. April 1912, No. 684.

some (amongst others Prof. MAKEN) would recommend the aim to be: 1) an increase in flesh by developing the early maturity qualities of the Bergamo breed and using superfluous animals from the breeding pens for the production of mutton; 2) a higher production of wool, with special care to avoid injury to the fleece of the Sicily, Sardinia, and Lecce breeds, crossing exclusively with Merinos but using selection only. With Carabaillet Merinos, on the other hand the crossing should be continued with breeds already possessing a fair share of Merino blood. The production of Astrakhan-like fleeces should be tried where brown varieties, etc., are available. Others, instead, chiefly advocate the improvement of wool production. BOXA divides the sheep of Italy into three varieties: 1) wools of Apulia, Vissane, and Sopravissane, which are deficient only in length and quantity, but are good for combing; 2) some Latinum wools (e.g. Cuneo, etc.) and wools of the Marche, Umbria, the Apennines, Basilicata, and Calabria, which are uneven, weak and coarse; 3) Tuscan, Bergamo, Venetian, and Piedmontese wools which are not good from an industrial point of view. For the improvement of the first variety BOXA recommends selection alone; except for the short-fleeced Apulia sheep where he advises crossing with Australian Merinos from Port Philip, or better still with the selected Port Philip Merinos or Lincoln, obtaining wool sometimes as long as $5\frac{3}{4}$ inches long. To improve the wools of the second variety he advises crossing with Apulian Merino rams, or Southdown, Dishley or crossbreeds, $1\frac{1}{4}$ Dishley $\frac{3}{4}$ Merino. The wools obtained by these crosses are more even, sufficiently fine and silky, and fetch good prices. For the third variety he advises the employment of Southdowns, Dishley rams or $1\frac{1}{4}$ Dishley and $\frac{3}{4}$ Merino cross breeds.

Tests on Milking Ewes in Hungary for Yield of Milk and Wool (KOVACS, L.) in *Kirchbaur-Koelmenitz* (Communication of the Hungarian Agricultural Station, 1915, XVIII, Part. 5/6, pp. 527-562) (19. XII.) Summary in German on pp. 527-530; complete, 1915.

The breeding of sheep for milk has always been extensively practised in Hungary, especially in the mountain regions. During the last twenty years the total number of sheep has diminished, but in a much lesser degree milking ewes than for other types, so that now the former are by far the most numerous. The agricultural conditions in Hungary are favourable to this industry for in several regions the increase in farming is closely connected with the breeding of milking ewes. The methods used are, however, still very primitive and very little is done to develop the capacity for milk production. In many of the flocks small attention is paid to selection while fine testing for yield is still less carried out. Generally speaking the flock has been neglected, and few data can be obtained as to the limits of fluctuations of the milk yield in a flock.

It is therefore very desirable to direct the attention of sheep breeders to this line, and it is with this object that the writer has carried out experiments in 3 flocks, of which one consisted of Zigaia or East-Frisian crossbreeds (on the Végles farm in the district of Zólyon) and two of Zachel sheep (on the Felsőkübin farm in the district of Arva, and on the Szentandrási

farm in the district of Liptó.) In each flock a certain number of sheep of the same age were chosen for the experiment, viz.: 29 at Végles, 27 at Felsőkubin and 20 at Szentandrás.

In order to determine the quantity of milk produced, test milkings were carried out every fortnight, and samples were kept showing the difference between the morning and evening milking, by which the fat content and the curd content obtained were determined. Besides the milk production, determinations of the quantity and quality of the wool were made. The results were obtained regarding the weight of the fleece, the loss per cent in washing, and the results of the classification of the wool.

Tests of milk yield. — Unfortunately, the observations were discontinued before completion and thus it was not possible to determine the exact milk yield in any of the flocks. However, the observations made at Végles during 5 months, at Felsőkubin and Szentandrás during 4 months, and the comparison between the quantity of milk obtained in each of the flocks during 3 months of milk production, have given some useful data regarding the variations in yield of the sheep under test. The results are shown in Tables I and II.

TABLE I. — *Yield in milk, fat and curd during periods of 4 and 5 months*

Locality	Milk yield per sheep lbs.	Fat yield per sheep lbs.	Curd per sheep lbs.
Végles (5 months)	53.86 — 210.32	3.42 — 13.07	12.74 — 47.70
Felsőkubin (4 months)	65.08 — 171.74	4.08 — 13.44	14.63 — 44.40
Szentandrás	60.89 — 207.50	4.08 — 14.44	13.73 — 44.40

TABLE II. — *Variations in the milk yield during 3 months*

Locality	Minimum yield lbs.	Maximum yield lbs.	Mean production per sheep		
			Interior lbs.	Middling lbs.	Grading lbs.
Végles	21.78	109.47	34.61	52.55	64.10
Felsőkubin	43.83	125.44	57.10	81.53	110.40
Szentandrás	51.35	158.78	60.80	81.66	112.70

The wide differences to be observed in the milk yield of the same flocks show how great an advantage could be obtained by selection based on the results of similarly accurate tests.

Tests of yield of wool. — The results of these tests have amply proved their importance. Although, when breeding sheep for milk, wool must be

considered secondary, it nevertheless constitutes an equally important part of income.

On the basis of practical experience, it is generally admitted that an inverse proportion exists between the two factors "milk yield" and "wool yield", whilst the relation is direct between the two factors "milk yield" and "fineness of wool". The results of the investigations have in various cases, confirmed this principle, but in others, the contrary is apparently observed. An abundant milk production appears to be associated with an abundant wool production. The Végles flock for instance, amongst the 5 best milk sheep, which produced also the largest quantity of wool. Szentandrás also gave 3 sheep presenting this double attribute, while at Felsőkunin no example of the kind occurred. In choice, tests for yield would certainly be more difficult for sheep than for pigs; but such difficulties are not insurmountable. It would be therefore very advantageous to make these tests on a chosen group, and not on the whole number of mother ewes. This would soon ensure good progress, if the rams could be chosen exclusively from heavy milking stock. If milking tests were furthermore practised on all the mother ewes at intervals, it would be possible to eliminate the inferior ones and their progeny, thus only improving the milk production of the flock.

Ground Wheat versus Whole Wheat for Fattening Pigs. — I. BUES, R. K. and L. C. B. — II. SNYDER, W. P., *The University of Nebraska, Bulletin of the Agricultural Experiment Station of Nebraska*, Vol. XXVII, Article 1, *Fattening* No. 14, pp. 1-11, 1913. (Also *Trans. Lincoln, Nebr.*, August 15, 1913.)

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I. — *Ground Wheat versus Whole Wheat for Fattening Pigs.* — Since in certain localities in the State of Nebraska it often happens that many farms have an abundance of wheat and little or no maize, the Department of Animal Husbandry of the Agricultural Experiment Station at Lincoln has stated an experiment to determine the relative feeding values of whole wheat and ground wheat when fed to fattening pigs. It was not considered necessary to compare wheat with corn in this experiment, owing to the fact that other Experiment Stations have found ground wheat about 10 per cent more efficient than shelled maize when fed to fattening pigs. The economic advantage of ground wheat over maize as a feed for pigs is largely lost by the additional expense incurred in grinding and feeding the wheat.

Forty spring pigs divided into four lots of ten each were used in the experiment. One pig in lot 2 died at the close of the second week and was eliminated from the experiment. The following rations were fed:

- Lot 1. — Soaked whole wheat.
- Lot 2. — Soaked whole wheat 10 parts, tankage (slaughter house refuse) 1 part.
- Lot 3. — Soaked ground wheat.
- Lot 4. — Soaked ground wheat 10 parts, tankage 1 part.

In establishing prices for feeds used, whole wheat was valued at 75 cents per bushel and tankage at \$2.50 per cwt. A charge of 4 cents per bushel was made for grinding the wheat.

The experiment was begun October 27, 1913, and closed twelve weeks

later, January 19, 1914. The following table gives the main facts in connection with the experiment:

TABLE I. — *Comparative value of rations for pigs.*

Lot	1	2	3
Number of pigs in lot	10	1	10
Weight of lot at beginning lbs.	1,300	1,245	1,370
Weight of lot at close	2,005	2,070	2,370
Total gain by lots	705	825	1,000
Average first weight per pig	130	124.5	137
Average last weight per pig	200.5	207	237
Total gain per pig	70.5	81.6	100
Average daily gain per pig	16.84	19.6	23.8
Total feed consumed:			
Wheat	4,100.4	5,007.5	4,120.1
Tankage	—	195.5	—
Feed required for 100 lbs. gain:			
Wheat	591	485.8	412
Tankage	—	23.9	—
Cost of 100 lbs. gain	8	7.37	6.67

When wheat comprises the entire feed for fattening pigs:

- 1) Three pounds of soaked ground wheat produced as much gain as 4 lbs of soaked whole wheat.
- 2) Ground wheat at \$1 per bush. proved as economical as whole wheat at 75 cents per bush. At a cost of 4 cents per bush. per grinding, the profit due to grinding amounts to 21 cents per bush.
- 3) Ground wheat produced gains 42 per cent faster than whole wheat.
- 4) A noticeable amount of wheat passed through the pigs undigested.

When a mixture of 10 parts wheat and 1 part tankage comprised the entire feed for fattening pigs:

- 1) Six pounds of ground wheat produced practically as much gain as 7 lbs of whole wheat.
- 2) Ground wheat at 86 cents per bushel proved as economical as 75 cents per bush. when both were fed with tankage. At a cost of 4 cents per bush. for grinding, the net saving due to grinding amounted to 7 cents per bush.
- 3) Ground wheat produced gains 21 per cent faster than whole wheat when both were fed with tankage.
- 4) The whole wheat was apparently better digested when fed with tankage than when fed without tankage.

Ground wheat proved more profitable than whole wheat for fattening pigs, either when fed with or without tankage.

These facts lead to the following conclusions: A great saving can be effected by grinding the wheat for fattening pigs. Pigs can be fattened and packed on a shorter feed with ground wheat than with whole wheat, owing to the faster gains made and the better finish obtained, small amounts of tankage can be profitably fed with ground wheat. In case grinding of wheat is not practicable, a small amount of tankage fed with whole wheat will materially increase the rate of gain and, on the basis of prices given in this paper, will materially increase the profit obtained.

II. -- *Unpublished Data from the North Platte Station.* The following furnish additional proof as to the economic advantage of ground wheat over whole wheat as a feed for fattening pigs.

Table II. -- *Wheat and maize for fattening pigs. Wheat compared with maize; whole wheat compared with ground wheat; soaked wheat compared with unsoaked wheat.*

Average of two tests: October 21, 1914, to January 15, 1915, at North Platte.

There were 50 pigs in each lot, 50 pigs in all.

Ration	Stuffed maize (50%)	Whole maize (50%)	Whole wheat (50%)	Ground wheat (50%)	Ground wheat (50%)
Initial weight per pig	118.2	119.0	119.4	118.5	119.0
Final weight per pig	212.0	209.4	211.4	211.4	211.4
Net gain per pig	100.4	100.4	102.0	102.9	102.9
Net daily gain per pig	1.11	1.07	1.04	1.05	1.11
Net gain for 100 lbs. gain	90.8	100.0	94.4	100.0	94.4
Net feed for 100 lbs. gain	11.0	12.0	10.0	10.0	11.0
Net feed for 100 lbs. gain	12.0	12.0	11.4	11.4	11.0
Cost of feed for 100 lbs. gain	\$1.18	\$1.42	\$0.94	\$0.94	\$1.10

On the basis of the following prices: Stuffed maize 6 cents per bushel; whole wheat 40 cents per bushel; ground wheat 29 cents per bushel; alfalfa 8 cents per ton.

On the Use of Fern-root (*Pteris aquilina*) in German Pig-feeding Experiments. -- HANSEN and MUEZ (University of Koenigsberg in *Zeitschrift fuer Tierernahrung*, Year 15, No. 22, p. 197, Berlin, March 1, 1916).

The writer has made a special study of this fern (*Pteris aquilina*), which is very abundant in Germany, and believes that the root might serve as food for pigs. It is rich in food material, is easily collected, and has even been used as human food in times of famine. The analysis made by the Agricultural Institute of the Koenigsberg University shows the chemical composition of this root to be:

Crude fiber	15.1%	Crude Cellulose	15.1%
Protein	3.0%	Nitrogen-free extract	2.5%
Protein	3.9%	Ash	1.0%
Protein	0.7%		

The amount of food material is therefore relatively high. Unfortunately the large proportion of crude cellulose slightly diminishes the digestibility of the other constituents. The writer has also carried out some feeding experiments on cows and pigs with this root. The cows refused it, probably because of its bitter taste. The pigs, on the contrary ate it, at first in small quantities. The writer chose for his experiments some young pigs weighing about 44.09 lbs. At first they were given 0.22 then 1.10 and finally 1.45 lbs. of root per head daily. Though this experiment had to be stopped for a certain time, it has, however, proved that fern root is a good food for pigs if no intestinal derangements occurred. The writer is at present making feeding experiments with pigs of the average weight of 55 and 66 lbs. The quantity of fern-root given daily was at first 0.66 lbs. per head, but at the present time the quantity has been increased to 2.25 lbs. per day per head. Although the experiment is not yet finished it confirms the previous trial in showing the fern root to be a good food for pigs. The writer is continuing the experiments and advises others to repeat them.

512 **Report of the Third Egg-Laying Competition Held in Ireland from October 1914 to August 31st 1915.** MEMOIR I, in *Department of Agriculture and Technical Instruction for Ireland*, Vol. XV, No. 6, pp. 80-88, Dublin, October 1915.

The Third Irish Egg-Laying Competition conducted by the Department of Agriculture and Technical Instruction for Ireland was held at the Mease Institute, Cork.

In addition to 15 non-competing pens, there were 33 pens (each of fowls) of the following breeds and varieties: White Wyandotte, - - - Island Reds - - - Buff Orpingtons - - - White Leghorns - - - Brown Leghorns - - - Black Minorcas - - - Red Sussex. The 4 first places in the 11 most laying record belong to the White Wyandotte pen. The best Wyandotte laid 271 eggs in 47 weeks and was still laying well at the close of the competition.

The observations made during the competition confirm the belief that small eggs, especially in the case of the White Wyandottes, are in a great measure due to the use of male birds; the progeny of heavy layers of small eggs; these observations also showed that undue tendency to broodiness is transmitted by the male parent.

513 - **Recent Research on the Ascent of Rivers by Salmon.** - - ROULE LOUIS, in *Comptes Rendus de l'Académie des Sciences*, Vol. 151, No. 23, pp. 707-709, Paris, December 1910.

The factors determining the ascent of rivers by salmon are governed by the proportion of oxygen dissolved in the water. This is proved by the ascent of salmon taking place only in those rivers where the proportion is near the limit of saturation, or surpasses it by the occurrence of supersaturation, already noted by several observers. This view is based on previous researches made by the writer in the spring, and is confirmed by others carried out in the autumn and described in the present notice.

The direction of the migration proceeds from areas of low oxygen content to those of higher content, the maximum being always present when the salmon will spawn.

The salmon ascending from the mouth of the estuary and after entering the river makes its way continuously towards the place suitable for spawning (with the current on a rising tide and against the current on the ebb) towards an area rich in oxygen and favourable to increased respiration. The practical conclusion to be drawn is that, when stocking rivers and streams with salmon, only those should be chosen that are naturally rich in oxygen, otherwise the operation would probably fail.

Researches on the Toxic Effect of Sulphuric Acid on Pond-fish. HARMON L. COLE, *Z. f. Fischk. u. Fischkult.*, New Series, Vol. I, No. 1, pp. 355-367, Berlin, 1915.

Water coming from industrial establishments often contains sulphuric acid and if allowed to flow into ponds used for pisciculture, may be injurious to the fish. The writer's object is to ascertain to what extent the theory is correct. Several fish (carp, trout, and salmon) were placed in an aquarium containing chemically neutral water (cold or tepid) to which sulphuric acid was afterwards added in different amounts. The same experiment was made, for purposes of comparison, with invertebrates (*Gammarus pulex*, *Chloëa dipterum*, *Tubifex tubifex*, etc.).

The experiment proved that the free sulphuric acid has a toxic effect both on the fish and on the invertebrates. In the water to which 20 or 40 mgms. of SO_3 were added per litre the toxic effect upon the fish was slight; with a dose of 140 or 150 mgms. the toxic effect was very marked. Considering that the pond water is more or less rich in lime which partly neutralizes the acid, it may be admitted that in practice 100 mgms. of the acid per litre will be necessary to produce a noticeably toxic effect, and 200 mgms. to produce an markedly toxic effect. The rate of poisoning depends also on the temperature of the water, as at low temperatures the fish are more resistant, being more able to neutralize the acid in the water. If the water is too acid, the fish secrete an excess of mucus in order to protect the branchiae and epidermis from being injured by the acid.

The writer has also examined the dead fish poisoned by the sulphuric acid. In one case where the water contained 140 mgms. of pure acid per litre he found a slight acid reaction in the fresh mucus. On the other hand in some cases where the dead fish had remained in that condition 24 hours it was impossible to find any trace of the acid either in the branchiae or the intestines. The writer therefore believes it to be exceedingly difficult to determine whether the fish has been poisoned by the acid; this can only be done when the fish has died from acute poisoning and has been examined immediately after death. In practice such cases are rare.

The behaviour of the invertebrates is slightly different. The common freshwater shrimp is the most susceptible to the acid and dies in 5 hours if the water contains 20 mgms. of concentrated sulphuric acid per litre. With the same dose, the larvae of *Chloëa dipterum* die only after ecdysis; finally they can withstand as much as 40 mgms. of the pure acid. The most resistant of the invertebrates are *Asellus aquaticus* and *Tubifex* *le-*

bifex; the toxic doses of concentrated sulphuric acid per litre are 80 mgms. for the former and 100 mgms. for the latter.

515. **Damage caused to Fish-culture in Hungary by the Residual Waters from Sugar Manufactories.** See No. 557 of this *Bulletin*.

516. **Fish-culture and the Biological Purification of Sewer Water at Charkow (Sour Russia).** *GAZETU in Kharkovskoe* (The Farmer), Year XI, No. 132, pp. 1-2, 1916, January 1, 1916.

Until quite recently fish-culture had not been applied to the biological purification of sewer water in any Russian town. Recently, however, the Municipality of the town of Charkow constructed the first biological station for purifying sewer water by means of basins and filters. From the filter the water passes into ponds containing fish, through the agency of which it is definitely purified. There are 3 ponds which cover a total area of 12 acres. In the spring of 1915, 215 yearling carps were placed in the ponds. Towards the end of July the carps weighed 1 $\frac{1}{4}$ lbs. This small increase in weight can be explained by the sandy nature of the soil. The first attempt to breed carp was made in 1914, and failed, all the fish died in the winter. The mortality was caused by the low oxygen content of the water, which was covered by a layer of ice. In these ponds the only possible method is therefore to stock the ponds with fish in spring and catch the fish in winter. The number of ponds at the Charkow Biological Station will increase in proportion to the increase of the sewage water.

FARM ENGINEERING.

547. **Duty free Admission of Agricultural Implements and Machinery into Greece.** *The Implement and Machinery Review*, Vol. 31, No. 102, pp. 1310-1311, 1916, April 1, 1916.

A Royal Decree has been published in Greece, which exempts the following articles for a period of four years from January 1st 1914, 1916, from State import duty and from harbour, communal, municipal, or other taxes on importation into Greece from abroad, or on being transported from one district to another in Greece, viz:

Ploughs and hoes.

Harrows, clod breakers and horse hoes (cultivators).

Machines for sowing, for planting potatoes and for distributing manures.

Harvest machines *i.e.* reaping machines, mowers, hay turners, hay gathering machines, machines for digging up potatoes, and threshing machines, as well as implements for reaping and threshing.

Machines for cleaning and sifting seeds, ginning (shelling) machines, machines for preparing fodder, hay pressing machines and straw elevators.

Implements and machines for combating vegetable and animal pests and diseases.

Implements, machines, utensils and tools for wine-making, for the

lark, butter and cheese industries, for the olive oil industry, for apiculture, sericulture, poultry farming, viticulture, arboriculture and for fruit and vegetable packing.

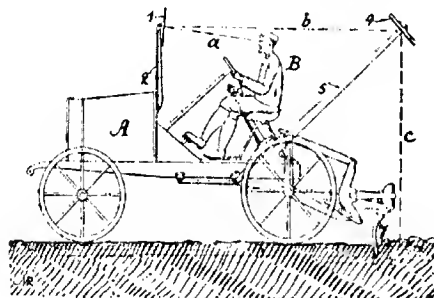
Motors for reaping or threshing machines *i. e.* motors worked by horses, by steam or electricity or driven by crude petroleum and petrol.

Means for the conveyance of motive power, *i. e.* leather belts, chains and wire for conducting electric power.

Pumps.

127. **Mirrors for Motor Tilling Machines.** — MAX RINGELMANN in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 114, 2nd half year, No. 6, Vol. 124, p. 200, 1 fig., Paris, November-December 1914.

With most outfits for mechanical tilling the driver is obliged to turn round and look backwards, in order to see the work that he is doing. With



MIRROR BY MESSRS. PUGNOT BROS. AND GOBIET

the object of avoiding this, Messrs. PUGNOT BROS. and GOBIET of Valentigney (Doubs) have patented (English patent No. 12747, May 1915) the use of mirrors 1 and 4 (see accompanying figure) mounted on suitable supports

and 5 fixed to the motor A. The inclination of the mirrors can be so adjusted as to allow the driver B to see in mirror 1 the work which is being done by the implement 7 and alter it at will.

This device, especially suitable for small one-man outfits, can easily be applied to any machine.

128. **A Chaff-cutter for Litter, provided with Pneumatic Delivery and Press.** — In *Abstrakte Landwirtschaftliche Zeitung*, 35th Year, No. 20, p. 142, 1 fig., Berlin, March 8, 1916.

An appreciable economy of litter can be effected by using the straw cut up into small pieces, but the extra work required for this cancels any benefit resulting from the process. The machine described obviates this extra work, being constructed for coupling up with a threshing machine, instead of a straw press.

The machine, made by Messrs. WILHELM LANVERMEYER of Melle (Han-

nover) and patented under No 259 469, in Germany, belongs to that type which a rotary toothed mill ("umlaufende gezahnte Scheiben") presses.

Chaff-cutter for Litter, provided with Pneumatic Delivery and Press.

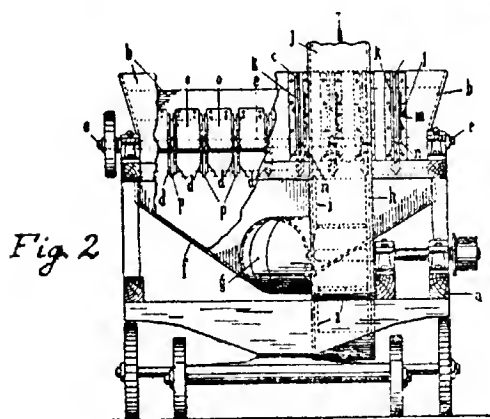
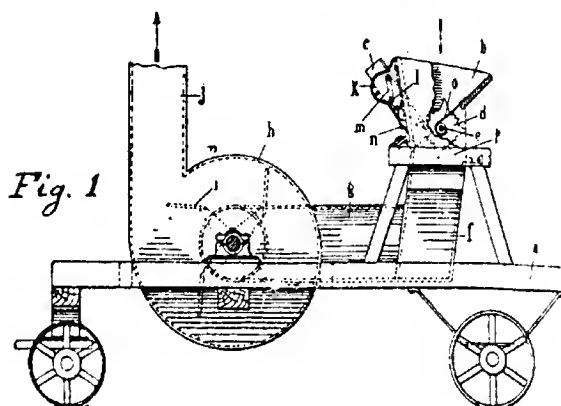


Fig. 1: Side elevation.

Fig. 2: Front elevation.

straw against fixed knives, but it has the following advantage over other patterns: the knives can be removed and changed while the machine is running and they are protected from injury by foreign bodies introduced

to the machine by means of flexible supports, which allow them to move back into the machine. The machine is also provided with an apparatus which sucks up the cut straw and then forces it towards the place where it is to be used or stored.

In fig. 1, the machine is seen in side-view and in fig. 2, from the front (breadth). Fig. 3 shows the cutter on a larger scale in longitudinal section.

Detail of Chaff-cutter.

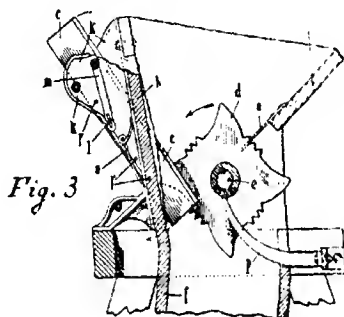


Fig. 3

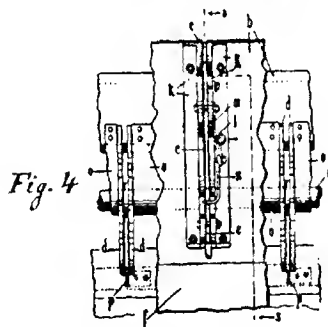


Fig. 4

Fig. 3: Longitudinal section.
Fig. 4: Corresponding front view

While fig. 4 gives the corresponding front-view showing how the bolt on which the knife works is mounted on a flat spring.

As shown in figs. 1 and 2, the straw-cutter, mounted on a slide, is composed of the following chief parts: a feeding-hopper *b*, a set of knives *c*, and the toothed mills *d* approximately square in shape. Under the mills, which are mounted in pairs on a moving shaft, is a gathering-hopper *f*,

communicating with the suction-pipe *g* of the apparatus *h* for suction and compression. The fan *i* of this apparatus forces the chopped straw into a pipe *j*, ending at the point where the straw will be stored. One of the sides of the hopper is adjustable and can be arranged drawer-fashion, in such a way that only the least valuable and lower portion of the straw would be sucked up, leaving the upper and more nutritive portions in the suction hopper, from which it can afterwards be removed for other purposes (e.g. for fodder). The straw cutter (figs. 3 and 4) carries, on a frame *k* fixed to the feeding hopper *b*, the knives *c* which turn round pins *l*, pressed by flat springs into the holes *l'* of the knives. When the upper end of the spring is screwed to the fixed part of the mechanism (fig. 4), the pin and spring can be pulled out sufficiently to allow the knife to be shifted by means of the holes *l'* either for removal, or for adjustment. Finally, when the pin is released, the spring presses it in place, provided that the knife is in such a position that the holes *l'* correspond with those of the chassis *k*.

The knives *c* are held by springs *n* so that their lower end is clear of the pairs of mills.

For the mills to work properly, the long straw should be fed parallel to the motive shaft and not allowed to roll around it. This is controlled by the guards *o* placed between each pair of toothed mills, fastened to the feeding hopper, and with their lower ends surrounding the shaft *e*. In addition, each pair of mills is separated by a scraper *p* which prevents the straw wrapping round the shaft. When the shaft *e* turns and with it the toothed mills, and long straw is fed into the hopper, the straw is taken in by the teeth on the mills and carried down on to the knives, which cut it, and the straw then drops down into the collecting hopper *f*.

If hard bodies, such as wood or stones, are fed amongst the straw into the cutter, they cannot press against and thus stop the shaft of the toothed mill, because owing to the springs, the knives can move back and allow them to fall underneath the cutter.

The chopped straw accumulates in the collecting hopper and is lifted thence by the suction produced by the apparatus *h* which forces it into the delivery pipe *j*.

The "Deutsche Landwirtschaftliche Gesellschaft" (German Agricultural Society) has described the machine as "new and remarkable."

550 - **Tree Felling by Machinery.** — *Engineering*, Vol. CL, No. 2618, p. 213, 1911; March 3, 1916.

A demonstration of tree felling by machinery took place in February last near Stirling, Scotland. The machine used was a No. 2 tree-feller guaranteed to fell any tree up to 48 inches in diameter. It was designed by Messrs A. RANSOME AND CO. The machine was supplied with steam from a 7 nominal-horse-power traction engine through a 120 ft. length of patent metallic steam hose covered with felt and canvas. This length allows all the trees within an area of about 1 acre to be felled without shifting the boiler. Though the ground was covered with snow, sufficient steam was kept up to run the machine at full speed.

Three trees, tough oaks of an average diameter of 46 inches, were felled in about 13 minutes each. Under normal conditions, trees varying from 42 to 48 inches have been cut in from 6 to 8 minutes, and spruce in about half the time. In the course of the demonstration it took 4 or 5 minutes to shift the machine, which is fitted with removable wheels, from one tree to another.

Usually a small portable 4 nominal-horse-power boiler which can be easily moved by one horse, is supplied with the tree feller. The advantage of the traction engine is that it can drag the trees where required after being felled.

The machine accomplished in a few minutes the work which would have taken two men four or five hours.

The trees were all felled at the ground level, and the clean cut made by the saw adds to the selling value of the timber, apart from the saving of wood. Only two men are required to work and shift the whole outfit. With the machine an interchangeable frame is usually supplied by means of which the trees can easily be cut to any required length after they have been felled.

(4) - Review of Patents.

Tillage machines and implements

Canada	166 550. Disk harrow.
	166 567. Harrow.
	166 576 — 166 762. Cultivator.
Italy	151 102. Turn-wrest plough.
	151 289. Plough.
Spain	61 299. Plough.
Switzerland	71 995. Shovel harrow.
United-Kingdom	23 116. Plough.
United-States	1 168 594. Disk plough.
	1 168 943. Cultivator.
	1 169 036. Plough attachment.
	1 169 127. Disk cultivator.
	1 169 156. Stalk cutter.
	1 169 183. Furrowing attachment.
	1 169 285. Attachment for ploughs.
	1 169 839. Means for shifting gang frames of cultivators.
	1 169 840. Adjustable gang frame for cultivators.
	1 170 114. Sharpening device for disk or disk harrows.
	1 170 581. Two-row cultivator.
	1 170 585. Plough.
170 635. Motor plough.	
	1 170 740. Disk furrow opener.
	1 170 761. Spring toothed harrow.
	1 170 879. Combined cultivator and weeder.

Manure distributors.

Canada	166 682. Fertilizer distributor.
	166 884. Manure loader.

Drills and sowing machines.

- Canada 166 275. Corn planter.
 United-Kingdom 21 965. Machine for sowing and cultivating cereals.
 United-States 1 168 859. Seed planter.
 1 169 055. Planter.
 1 169 275. Row marker for corn planters.
 1 169 945. Grain drill.
 1 170 237. Universal planter.
 1 170 696. Disk drill.
 1 170 785. Corn planter mechanism.
 1 171 178. Corn planter harrow attachment.
 1 171 206. Check row attachment for planters.
 1 171 239. Planter attachment for cultivators.
 1 171 265. Attachment for corn planters.

Reapers, mowers and other harvesting machines.

- Canada 166 686 — 166 309. Shocking machines.
 166 300 — 166 660. Sheaf carriers.
 France 475 095. Motor harvester.
 Switzerland 71 996. Cutting apparatus for mowers.
 71 997. Hay harvesting machine.
 71 998. Grass spreader.
 United-States 1 168 365. Machine for shocking grain.
 1 168 384. Mower attachment.
 1 169 031. Buts board for grain binders.
 1 169 048. Self binding harvester.
 1 169 647. Hay spreader.
 1 170 605. Fodding hay rake.
 1 170 692. Harvester.
 1 170 701. Rake.
 1 170 736. Hay sweep.
 1 170 799. Binder.
 1 170 882. Grain shocker for harvesting machines.

Machines for lifting root crops.

- Denmark 20 955. Machine for lifting and topping roots.
 United-States 1 168 804 — 1 169 229 — 1 169 673 — 1 170 944. Beet harvester.
 1 169 172 — 1 169 367. Potato diggers.

Threshing and winnowing machines.

- Canada 166 182 — 166 742. Threshing machines.
 166 463 — 166 848. Grain separators.
 Spain 61 386. Improvements in winnowers.
 United-States 1 168 282. Grain separator.
 1 168 550. Grain and seed separator and cleaner.
 1 160 040. Convertible cow-pea and small grain thresher.

Machines and implements for the preparation and storage of grain, fodder, etc.

- Canada 166 012. Feed mechanism for grain grinders.
 Italy 150 948. Esicxator for cereals: rice, wheat, maize, etc.
 Spain 61 056. Machine for cleaning, selectioning and sorting potatoes.

- Ireland 72 275. Groats cleaning machine.
 United Kingdom 21 359. Baling press.
 23 469. Mixer for chaff, bran, meal, chop etc.
 United States 1 168 898. Portable grain elevator
 1 169 300. Corn shredding and husking machine
 1 169 288. Rotary potato sorter.
 1 170 470. Hay baler.

Dairying machines and implements

- Ireland 166 057. Milking machinery.
 166 203. Milking machine.
 United Kingdom 21 867 - - 21 873. Cow milkers.
 United States 1 170 328. Cream separator

Other agricultural machines and implements

- Ireland 165 790. Shearing apparatus.
 166 032. Fruit sorter.
 166 036. Fowl plucking device.
 166 217. Egg candle.
 166 764. Wind motor.
 166 777. Conveyor mechanism for removing manure from stables.
 France 479 402. Circular saw, for felling trees, the teeth of which are alternate blades and planes.
 Germany 149 985. Machine for separating and cleaning grapes seed.
 151 216. Field tractor especially adapted for ploughing.
 61 409. New apparatus for raising water from wells.
 United Kingdom 21 255. Packing for hammers.
 21 360 - - 21 780. Oil presses.
 21 815. Apparatus for depericarping palm nuts etc.
 21 884. Chain pumps.
 22 390. Sugar cane mills.
 22 392. Feeding appliances for flocks.
 22 489. Oscillating churn for reception for coagulating rubber.
 23 411. Apparatus for seasoning timber.
 23 499. Apparatus for cleansing casks.
 United States 1 168 934 - - 1 169 155 - - 1 169 165. Tractors.
 1 168 975. Wind mill.
 1 169 732. Farm tractor.
 1 170 238. Gradual shifting draught hitch.
 1 170 583. Draught equalizer.
 1 170 673. Straw spreader.

RURAL ECONOMICS.

1. A Study of the Tenant Systems of Farming in the Yazoo Mississippi Delta, United States. — BOERGER E. A. and GOLDENWEISER E. A. in *United States Department of Agriculture Bulletin*, No. 337, 18 pp. Washington D. C., January 14, 1916.

RURAL
ECONOMICS

This study is based on 878 records which were secured from planters and managers of plantations, in 9 Counties in the State of Mississippi. The records referred to the crop year 1913, and were secured during March and

April 1914. In this region 76 per cent of the land is devoted to cotton, 21.2 per cent to maize, and only 2.8 per cent to other crops. Ninety-two per cent of the farms in the Delta are worked by tenants, 95.4 per cent of which are negroes. Three general systems of renting land are practised in the Yazoo-Mississippi Delta: share croppers, who supply nothing but their labour and receive one-half of the crop; share renters, who supply their own implements and live stock and receive two-thirds or three-fourths of the crop; and cash renters who supply the same items as share renters but pay a fixed rent in cash for lint cotton. The purpose of this research is to determine the effect of each of these three systems on the conditions and profitableness of the plantations, both for the tenants and for the landlords. The following table shows the relationship between the principal factors of production and the method of renting land.

TABLE I. — *Factors of Production in Relation to Method of Renting*

	All records	Share croppers	Share renters	Cash renters
Number of records	878	445	136	29
Acreage in crops per tenant	23.4	19.3	27.1	28
Per cent in cotton	83.0	88.0	77.0	81
Yield of cotton per acre (bales)	0.66	0.69	0.69	0.72
Yield of corn per acre (bushels)	24.0	24.0	23.0	24
Total value of farm property per tenant . . . \$	2 176.00	\$ 1 811.00	\$ 2 504.00	\$ 2 571.00
Total value of farm property per acre . . . \$	92.92	\$ 93.95	\$ 94.40	\$ 94.20
Value of implements and machinery per acre . \$	1.73	\$ 1.52	\$ 2.00	\$ 1.75
Labor income per tenant \$	392.00	\$ 333.00	\$ 368.00	\$ 475.00
Average earned by outside labour \$	23.00	\$ 27.00	\$ 25.00	\$ 18.00
Proportion of total income received by labour (per cent)	73.0	67.0	70.0	82
Average rate of interest on landlord's investment (per cent)	10.6	13.6	11.8	9.6

It will be seen that share croppers have a smaller acreage than share renters and cash renters, and that their land is more exclusively devoted to cotton than that of the others. Cash renters produce smaller crops than the share croppers or share renters in whose crops the landlord is directly concerned. The average investment is considerably less in holdings of share croppers than in those of share renters or of cash renters, but the difference is due very largely to the fact that the share croppers' holdings are smaller and less machinery is used on them. The total labour income of cash renters and share renters is superior to that of share croppers.

which is partly accounted for by the difference in size of the holdings; the largest income being \$ 18 per acre for cash renters, \$ 17 for share croppers and \$ 15 for share renters.

Out of every dollar earned by the farms, the cash renters in the Delta claimed 82 cents, the share renters 70 cents, and the share croppers 67 cents. The average rate of interest on the landlord's investment was 7.0 per cent on land rented to share croppers, 11.8 per cent on land in the hands of share renters, and 6.6 per cent on land operated by cash renters.

Forming different groups for the three systems, according to their labour income, an idea of the influence of the system on the amount of the labour income may be formed by comparing the number of tenants belonging to each group. At the same time the influence of these systems on the landlords' profits can be judged by adding to this the rate of interest received by the landlords in the same groups, as is shown in the following table.

Only one of the share croppers had a deficit during the year, and only 1 per cent of them made less than \$ 100; the great majority of the share croppers (86.3 per cent) had labour incomes of between \$ 100 and \$ 400, and only one-tenth of them made as much as \$ 500. Of the share renters 7 per cent reported deficits and 5.1 per cent positive incomes of less than \$ 100; about two-thirds made between \$ 100 and \$ 400, and more than one-fourth made \$ 500 and over. In the case of cash renters 4.1 per cent lost money and 5.4 per cent made less than \$ 100; but only a little more than one-half (53 per cent) had labour incomes of between \$ 100 and \$ 400, and 37 per cent made \$ 500 or more, as many as 25 or 8.4 per cent being in the \$ 1,000 and over class. This shows that the share cropping system was the smallest risk of losses and gives the surest profit to the tenant.

The share cropper is practically sure of receiving an average labour income, but will on the other hand rarely make a higher one. In the case of these renters, there are more failures, more very small incomes but also are probabilities of making a higher one; while for cash renters though the risk of loss is very high, there is also still greater probability of making an income above \$ 500.

For the landlord it is the reverse. The landlord made 1.1 per cent on his investment in the case of the share cropper who lost money and only 3.1 per cent where the tenant made under \$ 100, but the rate increases rapidly with the tenants' labour income, and in the cases where the tenant made as much as \$ 1,000 he gave the landlord a return of over 25 per cent. In the case of the share renters the landlord in no group averaged less than 7.1 per cent and his rate of interest rose as high as 16.6 per cent where the tenant had a labour income as high as \$ 1,000. In the case of cash renters the landlord's rate of interest varied within much narrower limits, the lowest being 5.7 per cent, where the tenants made less than \$ 100, and the highest 8 per cent where the tenants reported a deficit. The landlord is therefore assured of a return of 6 or 7 per cent on his investment independently of the tenants' labour income, where the land is operated by cash renters; where the land is worked by share renters or share croppers, the

TABLE II. — *Labour Income in Relation to Method of Renting.*

Class of tenants	Total	Deficit	Under \$ 100	Labour income									
				\$ 100 to \$ 199	\$ 200 to \$ 299	\$ 300 to \$ 399	\$ 400 to \$ 499	\$ 500 to \$ 599	\$ 600 to \$ 699	\$ 700 to \$ 799	\$ 800 to \$ 899	\$ 900 to \$ 999	\$ 1000 and over
Number having each income													
All tenants . . .	878	18	35	105	194	209	123	62	39	34	19	9	31
Share croppers . .	445	1	12	57	123	143	61	26	12	6	2	—	2
Share renters . . .	136	4	7	20	21	25	23	10	8	8	5	1	4
Cash renters . . .	297	13	16	28	50	41	30	26	19	20	12	8	25
Per cent having each income													
All tenants . . .	100.0	2.0	4.0	12.0	22.1	23.8	14.0	7.1	4.4	3.9	2.2	1.0	3.5
Share croppers . .	100.0	2	2.7	12.8	27.6	32.1	13.7	5.8	2.7	1.4	.5	—	5
Share renters . . .	100.0	2.9	5.1	14.7	15.4	18.4	16.9	7.1	5.9	5.9	3.7	.7	3.0
Cash renters . . .	100.0	4.4	5.4	9.4	16.9	13.8	13.1	8.8	6.4	6.7	1.0	2.7	8.4
Average income for each income group													
All tenants . . .	\$ 392	\$ 64	\$ 63	\$ 156	\$ 249	\$ 315	\$ 447	\$ 542	\$ 649	\$ 746	\$ 857	\$ 950	\$ 1,344
Share croppers . .	333	126	68	162	250	312	447	536	648	752	887	—	1,445
Share renters . . .	608	77	62	154	250	318	447	512	640	750	847	910	1,220
Cash renters . . .	128	26	50	110	215	311	418	511	650	744	850	910	1,350

landlord's rate of interest often falls below 6 per cent, but when the yield is good and the tenant makes a good return, the rate of interest may rise to five times that amount.

In other tables and diagrams the writer also shows the relationship between acreage in cotton and yield per acre, tenant's labour income and landlord's profits according to each system. The holdings of share croppers are considerably smaller, on the average, than those of share renters or of cash renters and there are few share croppers having as much as 25 acres in cotton, while about one-third of the share renters and of the cash renters are at least that acreage. The labour income of tenants increases directly with the increase in cotton acreage, but the rate of interest on the landlord's investment appears to be little affected by the size of the holdings. The principal factor in determining the amount of the tenant's labour income and the rate of the landlord's profits in this region is the yield of cotton per acre. The relationship between yield of cotton and labour income, however, is much closer on cash renters' farms than on those of share croppers, while the effect of yield on the landlord's profits is more apparent under the share cropping than under the share renting or the cash renting system. The tenant's incentive for securing a good crop is consequently greater among those who rent for cash, but on the other hand, the landlord is more directly interested in the magnitude of the yield per acre on the land of his share croppers.

Some Factors for Success in Farming in Wisconsin U. S. A. WASHINGTON: *U. S. A. Landlord's Diaryman*, Vol. 12, No. 3, pp. 97-98, Fort Atkinson, February 11, 1909.

Data collected from a large number of farms in Wisconsin have enabled the writer to study the relationship between the farmer's managerial income and the following factors: *a)* size of farm; *b)* working capital in proportion to fixed capital; *c)* quality of dairy stock; *d)* quality of cows; *e)* number of cows; *f)* quantity of foods bought in proportion to foods sold.

The results of these investigations are given in the following charts:

a) Size of farm.

No. of farm	Size in acres	Average acreage	Total receipts	Managerial income
10	Under 100	75	\$ 3,065	\$ 1,100
12	100-150	124	4,200	1,500
16	150-200	170	5,770	1,840
12	200-240	220	6,070	1,900
8	OVER 240	275	7,150	1,880

b) Working capital in proportion to fixed capital:

No. of farm	Percentage of fixed capital	Percentage of working capital	Managerial income
18	86.8	13.2	\$ 107,577
12	82	17.7	141,067
6	71.8	28.2	1,627,137
6	66	34	1,514,141

c) Quality of dairy sire.

Sire	No. of farms	Acreage	Total capital	Percentage of working capital	Total receipts	Managerial income
Grade	13	149	\$ 20,748	16.6	\$ 2,614	\$ 1,115
Pure-bred	23	167	21,990	17.9	4,429	1,815
Special	29	178	42,897	39.1	12,206	3,534

d) Quality of cows.

Class	No. of farms	Milk and stock receipts	Total receipts	Managerial income
All grade cows	19	\$ 2,770	\$ 3,572	\$ 1,115
Less than 30 % pure bred.	13	4,113	5,329	1,815
More than 30 % pure bred	10	5,739	6,980	2,534
All cows pure bred	8	9,395	9,594	3,534

e) Number of cows.

No. of farms	Average number of cows	Managerial income
9	11	\$ 643
9	17	1,422
15	23	1,815
10	35	2,534

f) Quantity of food bought in proportion to food sold.

Class	No. of farms	Ave. size acres	Total capital	Percentage of operating capital	Total receipts	Managerial income
Sales > purchases	26	173	\$ 23,129	18.6	\$ 3,669	\$ 1,115
Purchases > sales	28	160	39,650	31	5,644	1,815

From the foregoing charts regarding the region under consideration it is found that :

a) although the total receipts increase with the increase in acreage the managerial income remains about constant ;

b) the managerial income is greatly increased with the increase in percentage in operating capital ;

c) the quality of sires has a direct influence on the managerial income because of the high price attained by pure bred stock ;

d) the quality of the cows vitally influences the net profit, the best results being obtained by good dairy herds, or herds containing not less than 30 % pure bred cows ;

e) there is a very close association between the number of dairy cows on the farms and the managerial income, and the best results are obtained by herds of about 35 cows, which would warrant the employment of another man for the whole course of the year ; in practice this extra man is often the farmer's son who is constantly employed on the farm.

f) the purchase of concentrated feeds contributes to the increase of income, all the farms which buy more crops than they sell having a considerably superior income.

Farm Valuations for Book-keeping Purposes. — WATLEY, J. Lecturer on Book-keeping, West of Scotland Agricultural College, in *The Journal of the Royal Society of Agriculture*, Vol. XXII, No. 12, pp. 1215-1228, London, March 1910.

The new method adopted for assessing farm income tax in England has forced the writer to indicate in his article how the farmer should proceed to lay a sound and necessary foundation upon which he may construct whatever system of accounts he considers most suitable for his particular circumstances. The first step is to make a complete inventory and valuation of all the various classes of stock, both live and dead, upon the farm. He must also make out an accurate statement of all debts payable and debts payable, and ascertain how much cash he has in hand and in the bank. In other words, he must draw up a Balance sheet showing his total assets and total liabilities, and thence find out how much Capital he has invested in the farm. The annual revision of the Balance sheet will show whether the capital in the farm is increasing or decreasing, but not what profit or loss has accrued from a year's working of the farm.

Date at which the valuation should be made. The writer shows that the most desirable date will be that at which there is a minimum of variation to effect, for as regards book-keeping purposes, a valuation is, at best, to be looked upon as a necessary evil, which should be avoided as far as possible. This principle does not always coincide with local customs which are generally regulated according to the usual terms of entry to farms viz.: Lady Day (25th March) or Michaelmas (29th September) in England, and Whitsunday (28th May), or Martinmas (28th November) in Scotland.

The argument in favour of a spring rather than an autumn valuation is strengthened by considering the case of crops. At Michaelmas or Martinmas the crops will be largely harvested, and only a small part of seedlings for next season's crops will have been done. But only a small portion of the crop will have been disposed of either by sale or by consumption on the holding, and the extent of the necessary valuation will be very great. With a spring valuation, on the other hand, the greater part of the previous season's crop will have been realised, and only the costs of seedlings etc., for the current season's crop will need to be determined.

As regards live stock and other classes of dead stock the balance is also in favour of a spring valuation since the stock breeder's year, as well as in many cases the stock feeder's, generally commences in the spring rather than in the autumn.

In any case it would be desirable to delay stock-taking until at least a little of the previous year's crop remains to be disposed of. It may, therefore, be generally recommended that on the average cropping, stock feeding, dairy or mixed farm the valuation for book-keeping purposes should be made at the most convenient date between Lady Day and Whitsunday. In regard to the hill sheep farm, however, the best date would fall between about the end of August and the end of September, that is, after the season's

crop of lambs, etc., has been sold off, and the breeding stock made up the next season.

The principles of valuation. — Two leading principles in the valuation of stock of all kinds are enunciated by the writer, viz: 1) The values should not on no account be too high, that is, it should be possible at any time to realise the values put upon the stock. 2) Uncompleted articles of all kinds e. g. growing crops, young stock, etc., should be valued at cost of production up to date. Further, where it is not possible to fix the values automatically, that is, from cost-accounts, the valuation should be done by an independent party and preferably by the same party from year to year. Bearing these principles in mind, their application to the various classes of stock will be briefly examined.

a) *Crops.* — This section should give little trouble to the qualified valuer. Generally the basis of valuation should be *cost of production* up to date. With a spring valuation, the value would include the cost of the various tillages, seed, manure etc. whereas with an autumn one it would embrace summer cultivations and perhaps harvesting as well, along with a proportion of the yearly rent, rates and taxes. Hence the spring valuation entails an outlay of less labour, so far as growing crops are concerned.

Where cost accounts are kept, the values would be automatically determined in the respective crop accounts, but in the other cases (the general majority), and in any case for the first year or so, the cost of production would have to be estimated, per acre, for the various operations — ploughing, harrowing, drilling etc. In fact, it would be fairly accurate to keep the estimated cost per acre for each crop at approximately the same figure from year to year, although there would of course be differences in the number of acres of the various crops, which would affect the total value.

The advantages of a spring valuation are still more evident in the case of crops in stacks, pits, etc., (grain, potatoes, hay, straw, etc.) Their quantity in the spring is reduced to a minimum, thus the probable error which would occur in adopting the cost of production as the most rational method is much diminished. What generally happens, instead, is that the value fixes the values according to current market prices, or, it may be, on what is known as feeding or consuming value. So far as the consuming value basis is concerned, little objection can be taken from a purely book-keeping point of view, since the values are not likely to vary much from year to year. Not so with the market value basis, however, as neither farmer nor valuer can foretell the price at which the crops will actually be sold, or indeed whether they will be sold at all. The result must be that the profit or loss shown after such a valuation has been made can be but a purely fictitious or paper one.

The writer asserts that by far the soundest method of dealing with the crops under such circumstances is to carry them forward at cost. *A real profit can possibly accrue from produce which is still in stock.* Regarding also the difficulty, in dealing with harvested crops, of estimating the quantity the writer believes it a much easier way to take so many acres and value them at cost per acre.

Live stock. — With this class of stock also, the valuer would be well advised to base the valuations generally upon cost price, but there are certain important exceptions which must be dealt with differently. The fundamental object is not to show what the farmer is worth, nor yet to show what capital is invested in the farm, but to assist in the determination of the actual profit or loss from the year's actual financial operation. It is this object which the valuer must keep primarily in view: it is only under special circumstances that the other objects mentioned become of great importance.

Milk cows. — On the strength of this principle, the milk-cows on the farm cannot be valued at market price, because the increase of value due to the increase of market price for dairy cattle can only give a purely fictitious profit, as the cattle would have to be sold for the profit to be actually realised and no profit would accrue from the dairy produce of the farm. The primary object of keeping an account for cows is to discover the profit (or loss) from milk production and *not* to show what profit *might* be made *if* the cows were sold off.

The valuation on a cost basis is not applicable to such stocks for the reason that in a high class herd the values would come out lower than in a poor herd. The writer therefore fixes upon a third method, the "standard value basis" method, by means of which the average standard value of the cows in the herd is determined by calculating the increase in value of a 5-year-old cow, of good breed and quality, during the next two or three years, and then the decrease in value during the following three or four years, after which she is usually disposed of. In effect, the dairy herd should be looked upon as a factory for turning out milk (with calves as a by-product), the profit from which depends upon the price of milk, cost of feeding, labour, rent, etc., and only to very limited extent upon the market price of the cows themselves.

This method of valuation will apply more or less completely to all classes of breeding stock.

In referring to the valuation of cheese on the dairy farm, the writer believes no difficulty could arise as (if the valuation is made as suggested, at the spring) little cheese will be in stock, and in view of the extreme difficulty in accurately determining the cost of production it may be valued at a little under current market price.

Other classes of cattle. — Young dairy stock, home-bred, and purchased breeding stock, etc. should give little trouble and should almost invariably be valued on a basis of cost up to date, for here the *possibility* of a sale which might form a basis for valuation should be discarded for the *certainty* that the stock will only be sold when it is fattened.

Horses. — In the case of young horses not yet broken to work, the valuation should be on a cost basis, whether they are home-bred or purchased. The same principles apply as in the case of young cattle. Working horses, again, should not be valued at market prices but rather on the basis of an average valuation. The following method may be considered suitable: allow a certain figure as the value of an average three

year old filly broken to work. This may be called the "standard value" of three-year-olds, and should be such a value that the market value is not likely to fall lower, although it may be above the actual cost of production. In succeeding years it may be reckoned that the average horse will appreciate until a certain maximum is reached, after which depreciation may be allowed at a gradually increasing rate per annum until the horse stands in the books at, say, £2 at 18 years old. From a book-keeping point of view working horses are machinery, and should be treated strictly as such.

In valuing purchased working horses, consideration must be given to the purchase price and to any appreciation or depreciation in value since the date of purchase, but care should be taken that the valuation price never higher than the market value, although it may well be lower.

Other live stock. — As regards sheep, pigs and poultry, these should be dealt upon exactly similar lines as for cattle.

Machinery and implements. — This class of stock should present difficulty to the skilled valuer. At a first valuation, a detailed list may be made and approximate market value attached to each unit. Then, after a certain rate of depreciation may be allowed upon the sum total. The rate of depreciation will depend chiefly upon the nature of the machine, the care taken in handling and storing it and its age. A detailed valuation should be insisted on at least every five years in order to ensure that the valuations are not too high. A limit of depreciation may be fixed for individual machines below which the value will not fall. The implements should be valued in groups according to the department with which they are chiefly concerned. Since the market value of this class of stock is very problematical, care should be taken to keep the valuation low enough.

Other items in the valuation. — Purchased seeds, manures and feedstuffs will be valued at cost, plus the expense of bringing them to the farm. Tenant's fixtures (sheep-dipper, temporary buildings and fences, etc.) take over by the previous tenant will be valued at cost, less depreciation at, say, 10 per cent per annum. There still remain two items, viz. farmyard manure and unexhausted improvements, both of which present some difficulty and involve considerable difference of opinion as to how they should be valued. As to farmyard manure, some hold that it should not appear in the book at all, but be treated as part of the soil which undergoes a certain cycle of changes from soil to soil. The writer, whilst admitting this position to be sound under certain conditions, believes it to be quite untenable when concentrated foods are being purchased and used in large quantities. On many arable dairying and stock feeding farms the yearly profit depends very much upon the skill shown in the production and utilisation of this commodity; it should therefore be considered in the farm accounts. As it appears to be hopeless to attempt to fix the cost of production per ton, or to put a market value upon it, the writer believes it best to fall back upon some arbitrary "standard value" for a certain quality, the figures which are used in valuations between outgoing and ingoing tenants being accepted as suitable for the purpose in view. When the valuation is made towards the end of

any little farmyard manure may be in stock, as it may have been applied to the years' root crops. The only difference here is that the manure would be included in the cost of crops to date, instead of separately. The remaining manure may on a well managed farm be one of the most important assets. It includes the unexhausted value of such improvements as drainage, laying down permanent and temporary pasture, application of farmyard manure and certain artificials and consumption of feeding stuffs. Under the Agricultural Holdings Act, the unexhausted parts of such improvements are now a more or less definite market value, which must be based very nearly upon their value to an ingoing tenant, and this must be kept in mind by the valuer in assessing the amount lost a value be given to this asset which cannot be realised at the end of the tenancy, the only time it can be realised being indirectly by gradual exhaustion. In this case one has to follow the custom of the district in regard to outgoing valuations, and after the necessary preliminary assumptions have been settled the method is simple and should give little trouble to the valuer and book-keeper. The determination of these assumptions being, however, a difficult matter, and beyond the limits of the present discussion, the writer restricts himself to giving an example as a way of explanation and concludes that two points should be noticed: the first place that other items may also appear in the valuation, e.g. "acclimatisation value" on hill sheep farms, especially in Scotland, the "tenant right" on Ulster farms; and the "goodwill" on milk retailing farms.

These rules for compiling the annual inventories serve equally for the tenant and for farm owners; in the latter case, of course, the value of the farm itself will be an important item in its valuation.

AGRICULTURAL INDUSTRIES.

A Practical Method for Removing the Strawberry Flavour from Noah-grape Wines.

DEGANS C. in *Le Progrès agricole et viticole*, Year 33, No. 100, pp. 226-227. Montpellier, March 5, 1916.

The principle adopted consists in deodorising the must by removing the lees (which contain the ethers that give the characteristic aroma to the) and in consequence the ferments; then start the fermentation by means of the must of grapes possessing a pleasant flavour and smell.

To the pure, unfermented juice as it came from the press were added 10-32 oz. of potassium metabisulphite per 100 gals. of juice so as to completely inhibit any fermentation. The must, immediately decanted into casks had, in about 12 to 15 hours, deposited all the lees; it was then placed in the casks and fermented by adding from 5 to 10 % of active must from grapes lacking the strawberry flavour. After fermentation, the unpleasant flavour was quite gone. This method is applicable on a small scale. In large establishments the must to be deodorized should be filtered as soon as it comes from the press, and to this clear liquid, now free from ferments, could be added the must of the grapes possessing no strawberry flavour.

556 - **The Ferments of Pineapple Wine.** — POTQUÉ HENRI in *Comptes-Rendus des Séances de l'Académie des Sciences*, Vol. 162, No. 12, pp. 433-435, Paris, March 1916.

Some pine-apple juice, obtained by crushing the fruit, was placed in sterilized bulbs in some of which air was present, while in others a vacuum as possible was produced. The juice was then left to ferment spontaneously at a temperature of 28-30° C. By successive inoculations of nutrient gelatine, the writer was able to isolate from the first bulbs the yeasts *a*, *b* and *c*, and from the second, three yeasts *a*, *c* (identical to the previous yeasts) and *d*. The most important among these yeasts is *d*. The two yeasts *d* and *b* belong to the genus *Saccharomyces*, while *a* and doubtful ferments intermediate in character between *Mycoderma Torula*, with very weak fermentative action, yet not hindering, at least, at high temperature, the fermentation of the pineapple juice. The active yeast *d* does not appear to be favoured or complemented by the action of the other three yeasts.

557 - **Waste Waters from Potato-starch Factories in Hungary; their Noxious Action and Purification** (1). — HALMI J. in *Vizügyi Közlemények*, Year VI, Part 1, pp. 1-14, Budapest, January-February 1916.

This study contains the following chapters: I. A short description of the manufacture of potato-starch. — II. Quantity, kind and composition of factory waste waters. — III. Noxious action of these waste waters. — IV. Processes for purification (mechanical, chemical, biological).

In Hungary the fish industry has often suffered from the waste water coming from potato-starch factories; the object of this work is therefore to discover some means of improving previous methods of purification.

There are at present 24 firms manufacturing potato-starch in Hungary with 27 work-shops, 13 of which use potatoes; 6 maize; 2 wheat; 1 maize and wheat alternately; 1 rice and maize; 1 potatoes and maize; 1 potatoes and wheat; 1 maize and wheat. According to the statistics compiled by the National Hungarian Society of Manufacturers of Chemical Products, 1910, the 13 large potato-starch factories produce annually 354 240 cwt. of starch; the small ones 9840 cwt. In favourable conditions this production requires at least 2 558 400 cwt of potatoes. From the data collected at the factories by SAARE, DAMMER, WEIGELT, PAROW, KÖNIG and FISCHLER, the average volume of waste water from the factories may be calculated as 1.4 to 2.8 cub. ft per cwt. of potatoes, according to the methods of manufacture. The amount of waste water that the factories annually run to waste would thus be from 43 912 100 to 91 824 200 cubic feet. The damage caused by these waste waters is sufficiently serious, when it is considered that the entire working period of the factories does not exceed 3 or 4 autumn-winter months and that the expulsion of all this quantity is performed in about 100 days. The factories therefore evacuate daily during the period of activity from 459 121 to 918 242 cubic feet of waste water.

In previous purification experiments the best results were obtained by

(1) See *B. Feb.* 1915, No. 211; *B. Jan.* 1916, No. 92.

igation; but, to be successful with this method only 2100 cub. ft. of water per acre should be treated per day. Considering that the factories furnish daily 706 340 cub. ft. of waste water, 430 acres would, according to the preceding data, be necessary for the purification of such volume of waste water. But to avoid stagnation, the irrigated land must have if possible a year's rest, and this means that the factories would be obliged to dispose of 860 acres (about 04.25 acres per factory) plus drains with sufficient filtering power. This method was disproportionately expensive and for this cause was abandoned by the factories in favour of a mechanical system of purification.

The writer reviews the different methods used for studying the purification of waste water (DEGENER, ROTHE, SCHULTZ, KÖNIG, ROLANOS, SAARE, LIEBER DE CLAUBRY, ELSÄSSER, DAMMER, CALMETTE, ZAHN) and points out the defects in several. In Hungary the good results obtained from this method have given rise to a system which is based on the following principles: 1) purification of the water in which the potatoes are washed by aeration; 2) accumulation in special ditches of the noxious waste water obtained in the different manufacturing operations, and their emptying by fermentation. This way of solving the problem of the purification of waste water has given the most satisfactory results and is much more economical than either the method by dilution or the artificial biological method.

The various methods for applying this method may be summarized as follows:

Small factories working daily two wagon-loads, that is nearly 400 cwt. potatoes, require per wagon 0.33 gal. of water per second. The water required increases in proportion to the size of the factory. Those working daily 20 wagon loads (200 tons) of potatoes need per wagon 0.55 gal. per second of water, that is 11 gallons per second for 20 wagons. The volume of waste water ejected corresponds, naturally, to the amount used in the manufacturing operations. Two thirds of this quantity may be considered noxious; the other innocuous third consists of the water in which the tubers are washed.

The innocuous water should be run into a tank of sufficient capacity to contain not only the deposit formed by the water during the whole period of the factory's activity, but also the waste water itself, which therefore should be run through the tank at a speed of 5 mm. per second. The deposit generally amounts to 5 per cent of the material worked, that is 0.5 cub. ft. per wagon. The tank should be divided into several sections requiring of separate repairs. A kind of wire sieve with openings not above 10 mm. wide should be applied at the mouth of the tank to retain the potato fragments. To clear the water from any floating matter, a board or beam is placed across the exit opening of the tank. When all earthy matter is deposited at the bottom of the tank and all the floating matter is held back, the clarified water can be led into any water course without risk.

The waste water voided during 100 to 120 days of work (for small factories working 2 wagons of potatoes a day (say 706 000 cubic feet);

for large factories working 20 wagons a day (about 12 219 682 cph.) should be run over diked areas of ground with no outlet and there the water should be about 3 feet deep; in this case the area needed for small factories will be about 5 acres, and for large factories 85 acres. The noxious waste water will then evaporate and filter of its own accord; what remains is allowed to ferment and only when fermented allowed to run into other water courses. The authorities of the Water-supply Department fixes in each case the period of release of the purified waters. In the Hungarian climate, fermentation is completed after 4 months. The manured with the deposit of noxious waste water can be utilized for cultivation. The authorities are favourable to factories which desire large areas in view of enlarging their industry. This simple and economical method has been adopted with success by several factories, and appears to be as much adapted for general use as any of the other methods considered by the writer.

558 **Raisin Making in California; Influence of Ripeness on the Returns.** *Report of the College of Agriculture of the University of California, Year 1915, p. 17, Berkeley, Cal., 1915.*

BIOLETTI has shown the advisability of harvesting raisin grapes at more advanced stage of ripeness than is usually done.

The crop of Muscat raisins at Kearney increased 48.3 per cent between August 12 and September 23, making a net cash profit of 75.9 per cent.

The increase at Davis from August 26 to September 23 was 12.4 per cent in crop and 18 per cent in net profit. The increase in Sultaninas from August 5 to October 1 at Kearney was 34.1 per cent in crop and 47.0 per cent in net profit.

Much of this increase is often lost by harvesting the grapes too early. It could not all be saved for two reasons: 1) It is practically impossible to gather all the crop at the advanced stage of ripeness corresponding to the maximum crop; and 2) raisins made from the ripest grapes, while of the best quality for eating, are too "sticky" for the usual methods of handling in California. If the beginning of harvest were deferred until the Muscat showed 25° Bal. — the average would be about 26° Bal. for the whole crop — the crop would be of excellent quality and much larger than is usual now. Observations in six Muscat vineyards near Fresno indicated a loss from too early picking of from \$12 to \$22 per acre, or \$16 as an average for all.

The time required for drying increased in one experiment from 13 days for Muscats gathered August 17, to 34 days for those gathered September 16. The number of pounds of grapes required to make a pound of raisins decreases with advancing ripeness. The tests made indicate that 3.4 should be a minimum for Muscat and 3.8 for Sultanina, and a favourable average 3.2 for the former and 3.6 for the latter. Higher ratios indicate insufficient ripeness or losses in handling.

The Determination of Citric Acid in Milk. — KINZ RUDOLF in *Archiv für Chemie und Microskopie*, Year VIII, No. 4, pp. 12-133, Vienna, 1915.

Previous study on the citric acid content of wine, suggested the possibility of employing STAHR's test for the estimation of the citric acid in milk. Subsequent experiments have shown that it is possible to adopt this method by proceeding as follows: into a 200 cc. beaker pour 50 cc. of 10% and 10 cc. of sulphuric acid diluted with an equal volume of water; add 2 cc. of a 40% solution of potassium bromide and 20 cc. of a solution of phospho-tungstic acid; make up to 200 ccs. with distilled water, then shake and filter. Pour 150 cc. of the filtrate into an Erlenmeyer flask and add 25 cc. of a freshly prepared saturated solution of hydrobromic acid. Place the flask on a water-bath at 48-50° C. for 5 minutes, then gradually add 10 cc. of a 50% solution of potassium permanganate, shaking the mixture continually. For the remaining operations, proceed as in the case of the estimation of wine. To determine the amount of citric acid contained in 10 cc. of milk, multiply the weight of the pentabromacetone obtained by 1.215.

By this method the citric acid content of several kinds of milk has been ascertained. The following table gives some of the results obtained:

Quantity in grams of the citric acid content of 100 cc. of various samples of milk.

		Citric Acid	
Milk from a Vienna dairy		0.1167	0.150
Fresh milk direct from a healthy cow		0.1087	0.1386
Milk from a cow	at the beginning of milking		0.1080
	at the middle " " "		0.1012
	at the end " " "		0.1006
Milk allowed to curdle naturally	fresh milk not acid		0.1107
	milk slightly curdled		0.1206
	milk completely curdled		0.000
Yoghurt	fresh		0.1008
	after standing 24 hours		0.1082
	after standing 48 hours		0.1070
	after standing 72 hours		0.1045

From these results the following conclusions may be drawn:

1) The milk is richer in citric acid at the beginning and middle of milking than at the end.

2) In ordinary milk, the citric acid content diminishes progressively as the milk becomes sour.

3) Yoghurt is fairly rich in citric acid, which does not decrease even on keeping.

The conclusion is that by STAHR's method the estimation of citric acid in milk can easily be carried out.

560 - **On the Resistance of Non-Sporing Bacteria in Milk to the Action of Heat.** COSTANTINO in *Rendiconti del Reale Istituto Lombardo di Scienze e Lettere, Serie II*, XLVIII, Part XVIII, pp. 150-161. Milan, November 25, 1915.

It is admitted that sporing bacteria are the most resistant to the action of heat and the fact that other non-sporing bacteria are resistant to an unusual degree is attributed to the existence of particular races possessing a higher resistance to heat.

As it was observed that milk soured after sterilization contained no sporing forms, it was thought that this might be due to some special protective influence similar to that protecting pathological organisms. Experiments have shown that the protection is due to the formation of a coating of casein, caused probably by the biochemical action of the bacteria on themselves, before or during sterilization. Thus the explanation of the apparent resistance of non-sporing bacteria to the action of heat is more comprehensible.

It is therefore necessary to find out if this exceptional thermoresistance is a permanent character, common to the majority of individuals of a given bacterial race, or whether it is rather a protective phenomenon similar to that observed in milk. An observation of practical importance is that in none of the experiments made, was any case found of resistance to heat above 85° C., and no bacterium, even when artificially coated with casein, ever survived 90° C., whilst under normal conditions the bacteria resist sterilization temperatures of about 100° C. As the surviving bacteria, however, are localised in small clots of casein and have acid-coagulating properties, the difference is attributed by the writer to the marked difference between natural and artificial conditions, which does not, however, affect the theory that the thermoresistance is due to the protective influence of the coat of casein formed round the organisms.

561 - **Experiments in the United States Upon the Digestibility of Some Animal Fats.** LANGFORTH C. P., and HOLMES A. D. (Office of Home Economics) in *U.S. Department of Agriculture Bulletin No. 310*, pp. 22. Washington, November 9, 1914.

Notwithstanding the fact that fats are ordinarily one of the principal sources of energy in the diet and are $2\frac{1}{4}$ times as effective for this purpose as either protein or carbohydrates, their use in the diet has received little attention from investigators, and is consequently less perfectly understood than that of other nutrients.

It has generally been taken for granted that fats are thoroughly assimilated when eaten in favourable combinations, and that the different kinds do not vary enough in this respect to affect materially the amount of energy the body derives from them. The recorded experimental data, however, are not conclusive on this point. Experimental data are also very limited on another point - the relation of melting point to thoroughness of digestion, particularly with regard to fats of high melting point. It seems therefore desirable to study the digestibility of the more common edible and table fats prepared in a similar manner and incorporated in a critical basal ration.

The experiments described in this article were made with beef tallow.

lutton tallow, lard and butter. The digestibility was estimated from the weight and the analysis of the faeces. The total amount of the ether extract of the faeces did not, however, represent the actual quantity of undigested fat, but also contained metabolic products soluble in ether (bacteria, digestive juices, internal secretions and epithelial cells of the stomach and intestines). In order to determine these, the writers made 34 experiments with the basal ration without added fat. They determined the metabolic products present in the ether extract of the faeces and found that their quantity was equal to that obtained by the use of the basal ration when fat was also given.

Comparison of Digestibility and Metabolic Point

Fat studied	Coefficient of digestibility		Metabolic point	
	Determined	Waters' allowance for metabolic products	Waters' determination	Computed average value
	Per cent	Per cent	Degrees C.	Degrees C.
lard fat	94	97	32	28.46
beef fat	94	97	35	30.44
lutton fat	89	93	45	42.50
butter fat	80	88	50	47.49

(1) *Allen's Commercial Organic Analysis*, Philadelphia, Blackiston's Son and Co., 1909, 1911, Vol. 3, p. 72.

The average amount of water-free faeces occurring as metabolic products in the ether extract was 0.08 per cent. The coefficients of digestibility were calculated as follows:

$100 \times (\text{weight of water-free faeces}) \div \text{metabolic products, (Total ether extract)} - (\text{metabolic products}) \div \text{unutilised fat (Utilised fat)} \div \text{total fat eaten} = \text{per cent of digestibility.}$

All the fats included in this series of experiments were well-assimilated (for coefficients of digestibility see accompanying Table). The average amounts of fat eaten per subject, per day, during these experiments were 60 gr. of lard, 100 gr. of beef fat, 53 gr. of mutton fat and 100 gr. of butter. The average amount of protein consumed daily by the subjects was somewhat lower than that specified in dietary standards, but it was not considered essential to maintain any special nitrogen level. The values for the digestibility of the carbohydrate content of the diets varied from 6 to 97 per cent. The average energy value available per man per day, as calculated by the ordinary factors and the coefficients of availability found in the digestion experiments, was 2,235 calories for the lard, 2,739 calories for the beef fat, 2,145 calories for the mutton fat and 2,420 calories for the butter diet.

The average coefficients of availability of energy for the rations calculated were: 93 per cent for the rations containing lard; 92.7 per cent for the rations containing beef fat; 91.5 per cent for the rations containing mutton fat; 93.9 per cent for the rations containing butter. These values agree with one another closely and are somewhat higher than the value of 91 per cent which has been found to represent the coefficient of availability of energy of the ordinary mixed diet (U. S. Experiment Station Bulletin 136, 1903, p. 113). It is reasonable to conclude therefore, that the different fats did not exercise any unusual effect upon the digestibility of the other constituents of the rations. The accompanying Table allows of correlation being established between the digestibility of fats and the melting point.

It seems fair to conclude that, of those tested, the fats of low melting point are capable of more complete assimilation than those which have a high melting point.

The variation in the melting point of different samples of the same fat is consistent with the view that the melting point differs with the position of the body in which the fat is found, and also with the animal from which it is taken.

562. **Spanish Wools.** — *La Industria Pecuaria*, Year XVII, No. 510, 1915-1916, March 10, 1916.

Among European countries Spain is still, besides Portugal and Turkey, the most important exporter of wool. In the last three years in which the market conditions were normal, that is 1911-1913, the Spanish wool commerce was the following:

	Imports			Exports		
	1911	1912	1913	1911	1912	1913
Unwashed wool...lb.	210 052	114 292	270 980	23 640 192	24 105 278	30 136
Washed wool....lb.	2 140 596	2 378 904	1 585 821	855 119	9 114 035	1 051

The most valuable portion of the Spanish wool production is given by the crossbred flocks descending from the old and famous Merino flocks (Infantado, Curiel, Hinojosa, del Poular, de la Huelga, de Burgo, de la Cabana Real Española, etc.) the historical stocks have, however, in more than one case been intermixed, thus modifying their type. The present Spanish Merino wool, elastic, wavy, spongy and resistant, which (especially that of some flocks) competes in fineness with those of the same quality in France, Germany, Africa and Australia, is not so long as some of the best of those and rarely has the evenness acquired through the constant selection practised, especially by the Australian breeders.

Spanish wools may be classified as follows: 1) "*Fine merinos*." — Wools from Estremadura, part of West Andalusia, and principally from Cordoba, La Serena; also the quality named after Valle Mendia, and the wool obtained in Castile during the spring migration of the flocks to the mountains.

2) "*Semi-fine merinos*." — From the Andalusian Merino, a cross between Merino and the short fleece sheep ("rasa") which inhabits the most fertile parts of Andalusia.

3) "*Short wool*." — From the sheep of Aragona and Mancha, etc., amongst which may be distinguished for fineness the variety "*fin de season*" and the variety bred in the provinces of Cuenca, Toledo and Ciudad Real.

4) "*Wool from the 'churra' sheep (ciarrasa)*." — In large, resistant, shiny locks; although it lacks fineness it is good for spinning and is preferable for certain uses to the Australian twined wools. It comes from the mountains of Burgos and some parts of Estremadura and Andalusia, the plains of West Castile and the environs of Madrid.

5) "*Hacha wool*." — From a part of Navarre and from the province of Vascongadas; the production is of small importance.

6) "*Black Merinos*." — In the writer's opinion this breed, which belongs exclusively to Spain and the neighbouring zone of Portugal, is not worth rearing. It descends from the most ancient Spanish race of sheep and from the colour of its fleeces shows a marked relationship to races occurring in hot countries.

The prices of Spanish wools for the last two years per "arroba" of 35 lbs. were as follows:

Prices of Spanish Wools during 1914-1915.

Origin of Quality	1914			1915		
	Minimum		Maximum	Minimum		Maximum
	£	s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wool de Alcedin	19	9	1 2 0	1	1	9 6
Wool del Bucy e La Serena	1	1	0 1 2 0	1	0	1 11 8
Black merinos	11	10	1 1 5	—	—	1 0 2
Black	16	7	1 0 9	1	0	1 1 0
Wool "Semi-fine"	—	—	1 2	—	—	1 0 9
Rasa wools	10	7	1 0 2	1	0	1 0 2
Churra wools (prov. of Madrid)	15	0	1 5 10	10	0	1 1 1

Methods for Testing Fumigated Cocoons. — COLOMBO CATTOLIC IN *Entomologiae Scripta*.

Vol. III, No. 4, pp. 61-68, Rome, February 28, 1916.

The injurious action caused by fumigating cocoons with formalin, chlorine, hypochlorous acid and sulphurous acid, in order to destroy *Bombyx Bassiana*, has made it necessary to attempt to find methods suitable

for the control of cocoons bought by silk manufacturers at the time of harvest. In testing for formaldehyde, the method, long used by the Laboratory for Studies and Experiments on Silk (Padua, Italy), is that based on the formation of a more or less intense blue colour, when the silken covering of a cocoon, previously exposed to formalin vapour, is dissolved in concentrated hydrochloric acid (1).

For testing chlorine fumigations, now almost entirely given up on account of breeding, iodine tests are usually employed, or the chloride in the extracted ash are determined.

For fumigations with sulphurous acid, more often used by the breeders, tests have been found to be more difficult. The acid was estimated by precipitation of the H_2SO_4 obtained by treating the cocoon with alkaline water, all organic matter having been previously destroyed.

This determination, besides requiring at least a whole day, cannot be done conveniently, save in a chemical laboratory.

An attempt has been made to shorten the time required for testing of fumigated cocoons, by means of volumetric methods.

Direct titration with decinormal caustic potash and phenolphthalein could not estimate the very small quantity of H_2SO_4 present in the silks. Among methods of indirect titration, one based on the use of a dilute solution of disodium phosphate offered many advantages, and was therefore adopted and extensively tested. Results were obtained giving an average of about 65 % of the sulphuric acid present in the silk.

This method enables suspected cocoons to be sorted out rapidly and accurately, those being included which, according to the table of rules compiled for analysis by the writer, are included between the amounts 1.2-2.10 cc. of $\frac{KOH}{10}$ necessary to neutralize 150 cc. of liquid extract from 10 gr. of fresh cocoons on the one hand, and 20-25 cc. of $\frac{KOH}{10}$ (dried cocoons), on the other. As a general rule drying diminishes the delicacy of the test.

504 - Industrial Value of Japanese Yamamai and Sakusan Silks; Experiments in Italy. -- SEVERINI E. in *Informazioni Seriche*, Year III, No. 5, pp. 97-100, Roma, March 5, 1916.

The writer was charged by the Ministry of Agriculture, Industry and Commerce to examine several samples of Yamamai silk (*Antheraea Yamamai*) and Sakusan silk (*Antheraea Perny*) coming from the "Cooperative Society for the Yamamai and Sakusan Silkworm industry" of N. Boku, Adzumi-gori in Nagano Ken, Japan.

The experiments have shown that Yamamai silk has more brilliancy than European silks, but the difference is not such, even considering

(1) This colour reaction must not be mistaken for the well known reaction given by formalins dissolved in concentrated hydrochloric acid, which appears much more slowly, is more intense and has a decidedly violet tinge. (1)

special quality, as to constitute a decided superiority even for the latest types.

Furthermore, the high price (£ 2 13s. per lb.) is in itself an obstacle to the introduction of this silk into European weaving, even were it to fall considerably.

In all the tests made, Yamamoto silk proved inferior to the mulberry bombyx in many points essential for widely used silken articles, and not to be compensated for by any superior elasticity.

For specially strong and elastic textures, Yamamoto silk would, on the contrary, be an excellent material, as is shown by the tests for strength and elasticity made by the writer. Sukusan silk proved slightly superior for weaving to the Chinese Tussah silk, and may perhaps be preferred to it in the European markets.

Decree Regulating Butter Manufacture and Trade in Brazil. *Revista de Veterinária e Zootecnia, Publicação oficial do Serviço de Inspeção Federal de Alimentos, do Trabalho, Indústria e Comércio, year V, No. 6, pp. 262-264, Rio de Janeiro, December 1915.*

Decree No 3070, dated December 31, 1915, establishes that:

The name "*butter*" applies to the product obtained by churning cow's milk or cream, sweet or sour, free as far as possible from washing water and they containing or not containing chloride of sodium of suitable purity. Innocuous vegetable colouring substances may be added for a period of two years from the issuing of this decree. The manufacture and sale of butter obtained from the milk of other domestic animals is allowed, on condition that its origin be declared and that all the sections of this law be observed. Butter is considered adulterated when it contains less than 80% of fatty matter or has more than 15 degrees of acidity (normal alkaline solution in cubic centimetres necessary to neutralize the free fatty acids contained in 100 gr. of fatty matter). The sale of preserved or renovated butter (melted) is permitted on condition of its being declared as such. The sale of products similar to butter in appearance and use but of a different nature, is prohibited if they are described as butter. A reliable indication must be added to margarines. The name, trade mark, locality and weight must be declared on the wrappers of all fresh, preserved or melted butter, or its substitute.

The Government can institute official marks of guarantee both for fresh butters or preserved and renovated butters.

Offenders will be fined up to the maximum of 1 *conto de reis* (£ 114) and the penalty will be doubled for a second offence.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

566 - Injury Caused to Vegetation in Grounds near Ironworks at Terni Italy.

AMPOLA G. and VIVENZA A., in *Annali della R. Stazione chimico-agraria sperimentale di Roma*, Series II, Vol. VIII, pp. 139-164. Rome, 1916.

The grounds where vegetation has been harmfully affected are situated in close proximity to the Steel-works, and especially to two Martin N° 2 furnaces with two chimneys about 160 ft. high, and to a third smaller chimney belonging to some gas-works. The land is so situated as to receive all the smoke and gaseous products passing away from the chimneys. The clayey-calcareous soil is not favourable for the growth of pasture but is suitable for trees and bushes, especially vines, with which it is thickly planted, as well as with fig, apple, pear, apricot, peach, cherry, nut and olive.

Inspections were carried out at different times (spring, summer and autumn 1914) so as to observe the different stages of growth of the trees.

The following facts were ascertained: The vine suffers most among the woody species, about 20 % of the vines being either totally killed or withered down to the base of the stock. Some of the vines presented a miserable appearance; most of them were weak, with pale or shrivelled leaves and bore no fruit; some few bore imperfect bunches of fruit, finally, some, though weakened, bore grapes of an almost normal appearance. The vines still remaining in fairly good condition were not more than 25 % of the whole number and belonged to the varieties "canina", "bottafemmina", and "menaiolo". The varieties that were most affected were: "martone", "verdetto", "malvasia", "moscetta", "aleatico", etc. At vintage time, the reducing sugar content of the must was 14.6 %, and the total acidity 10.5 %; while normally the reducing-sugar content of the must in that region is 17 %. The effect of two distinct injurious actions have been observed on the vines:

1) a general decline of vegetative power consequent on previous attacks of disease, and perhaps of continued toxic action, characterized by stunted development of the branches, short internodes, abundant production of false-shoots, and small pale or reddish leaves.

2) scorching of the leaves, especially at the apex and round the margin, appearing suddenly from time to time. The macroscopic and microscopic examination of the scorched organs showed the characteristic effects of burning by hydrofluoric or sulphurous gases. Even ligneous plants such as the fig, apricot, peach and nut, are injured more or less seriously, but apple, cherry, elm and olive suffer much less—mulberry does not appear to suffer any harm. (the leaf, however, is not given to silk-worms for fear it may be injurious); willow, poplar, oak and hazel are perfectly unharmed. The damage caused to grasses (cereals, forage, and garden plants) are unimportant or nil.

According to the chemical composition and amount of the combustibles (coal and Spoleto lignite) consumed daily by the Steel Works, it is calculated that the chimneys pour out daily at least 12,010 lbs. equal to 8791 cubic feet of sulphurous anhydride. In the air over the grounds in question 0.00048 gr. of sulphurous anhydride were found per cubic foot of air on a day when the works were most active, and 0.00034 gr. per cubic foot of air on a day when their activity was less.

The determination of sulphuric acid and fluor in the leaves of the injured plants and in the must (many workers affirm they never have discovered any fluor either in the gemine wines or the very numerous varieties studied) gave (for dry matter) the following results:

		Sulphuric acid %
Fig leaves gathered June 25: sound		0.00
	injured	0.16
" " " August 20: sound		0.01
	injured	0.10
		Fluor %
Fig leaves: sound		0.0004
injured		0.001
Vine leaves: sound		0.0007
injured		0.0010
Must gr. per litre		0.000

The writers conclude that on the property they have investigated, the pines and apricots are destined to almost totally perish within a few years; figs and peaches will also for the most part die out.

12. **Mosaic Disease in Beets.** — LARSEN in *Tidsskrift for Planteavl*, Vol. 2, No. 3, pp. 444-457, Copenhagen, 1915.

In addition to an explanation of the nature of mosaic disease as it is best known among tobacco plants and other *Solanaceae*, the author gives a description of the special form found attacking beets. Hitherto it would appear to have aroused but slight attention, as it is only known from Den-

mark (since 1899) and a few other places, chiefly Southern Sweden, the Netherlands, of France and Berlin. In Denmark the disease is general among leaf-beets and causes great ravage among the seed crop, but is never found in root-beets. There was no difference whatever between the seed of plants attacked by mosaic disease and that from healthy plants sown under identical conditions; on the other hand, the rows which stood nearest to the beets severely attacked by mosaic disease were themselves attacked. The disease showed a considerable diminution, the greater the distance from the source of infection; at about 18 ins. from the affected seedling less than 100 per cent of the sown beets were affected by mosaic disease, but at a distance of about 10 feet only 10% were attacked in July. Later on in the autumn the disease spread over a radius of more than 200 yards from the parent beets. It is most likely that aphides and other insects spread the disease. Beets attacked by this malady in June grow to only half the size of healthy plants, while the parent beets affected by the disease only yield $\frac{1}{4}$ of the seed produced by healthy plants.

The experiments yielded the following results:

- 1) Mosaic disease of beets is not conveyed by the seed, but is transmitted under field conditions by the parent beets to those of the first year.
- 2) The virus of the disease occurs in the sap of leaves attacked by mosaic disease and cannot penetrate the plants save through lesions through young or immature parts of the stem and leaves.
- 3) Mosaic disease results in a smaller crop. With first-year beets which are infected through the veins of the leaf, the diminution of crop may amount to 30%, say about 150 cwt to the acre.
- 4) The disease can be prevented by only choosing healthy parent plants for transplanting in the following year, and lifting them with diseased implements.

The article contains, as appendix, a bibliography of 17 works.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

568 - **Report on Diseases of Agricultural Plants in Denmark, in 1914.** - LUDVIG ROSENKRANS, and KOLPIN RAVN. In *Tidsskrift for Plantemed.*, Vol. 22, pp. 267-295. Copenhagen, 1915.

Many of the diseases mentioned are the same as those of previous years. We can specify the following new observations: yellow-point-disease attacks *Avena sativa* in many parts of Jutland; it is distinguishable by the presence of dead leaf-ends. The disease is encountered most frequently on soil which is poor in nutritive properties in low-lying districts, and it would appear to be of a physiological nature. Turnips were violently attacked by *Erysiphe communis* in plots which had been well dressed with lime, but not on the experimental plots close by which needed a similar dressing. The leaf-roll disease of potatoes would appear to be dependent

on the quality of the soil; in some districts potatoes can be cultivated without being affected by this disease which causes the leaves to roll up, whilst in other parts they become so diseased after a year or two that the crop falls off materially, and the growers are forced to get fresh seed-potatoes from other districts.

A new disease of the stalks has been observed in *Medicago sativa*, which is due to *Marssonina Medicagois*. As a remedy for «Porrbleckkrankheit» manganous sulphate is used with good results, and is now employed to control this disease both in mangolds and oats.

Among noxious animals *Arvicola agrestis*, *Heterodera schachtlii* var. *secale*, *Oscinis frit*, *Silpha opaca* and especially *Plutella crucigerarum* have been very destructive.

94. The Study of the Diseases of Cultivated Plants in India. See No. 155 of this year.

95. New Fungi in Saxony (Germany). — BRESDORF G. in *Botan. Anz.*, 1913, Year 13, Vol. 1, pp. 104-106. Berlin, 1913.

Amongst the new fungi enumerated by the writer the following are worth recording: 1) *Phyllosticta Menthae* Bres. n. sp., on the leaves of *Mentha arvensis*; 2) *Phoma lupulina*, on the stems of *Medicago lupulina*; 3) *Microsporium roseolum*, on the leaves of *Acer platanoides*; 4) *Gli. acronum* (Det. var. *samaricola* on the same host-plant; 5) *Septoglerum Pastinacae* s. n. sp., on the leaves of *Pastinaca sativa*; 6) *Cylindrophora Fagi* Oudem. var. *candida*, on the branches of *Pinus sylvestris*; 7) *Macrosporum papaveris* Bres. n. sp., on the leaves of *Papaver somniferum*; 8) *Rhabdospora Lappae* on the stems of *Lappa officinalis*. The writer was not able to determine whether this fungus was identical with *Phylactaea Lappae* Jac. On the stems of *L. officinalis* a *Rhabdospora* with straight spores was found (*Rh. lusatica* Feenich n. sp.)

96. A Contribution to the Knowledge of Dalmatian Fungi. — JAAPPELTON J. in *Mycologia*, Vol. XIV, No. 1-2, pp. 1-14. Berlin, 1910.

The writer enumerates 510 species of fungi which he himself and others collected in Dalmatia during 1911; of these, 50 are new to science. The most worthy of mention are: 1) *Calonectria Gymnosporangii* Jaap n. sp., on *Gymnosporangium confusum* and on the branches of *Jasiperus phoenicea* and of *J. oxycedrus*; 2) *C. höhnchiana* Jaap n. sp. on the stems of *Ruscus villosus*; 3) *Gnignardia istrica* Bubák n. sp., on *Ruscus aculeatus*; 4) *Mycocharella saccharoana* Jaap n. sp. on old leaves of *Juglans regia*; 5) *M. medinis* Jaap n. sp. on living leaves of *Achillea Unedo*; 6) *Entyloma Pastinacae* Jaap n. sp., on living leaves of *Pastinaca sativa*.

97. A Contribution to the Biology of *Plenodomus fuscomaculans*, Injurious to Apple Trees. — CHONGS GEORGE HERBERT in *Journal of Agricultural Research*, Vol. V, No. 16, pp. 713-760. Washington, D. C., January 17, 1916.

This paper gives the results of experiments performed with *Plenodomus fuscomaculans*, a fungus parasitic on the apple. The specific pro-

11 See, B. March 1915, No. 324.

blem undertaken was the determination of the effects of various combinations of environmental factors upon the growth and reproduction of this fungus.

A brief retrospective glance of the historical development of the art of culturing organisms, from the first crude cultures to the present elaborate technique, and the simultaneous development of our knowledge of the physiology of organisms, shows that the environmental factors may greatly influence the life processes of the fungus in question. This *Plenodomus* was found to have a wider range of suitable conditions for growth than for reproduction.

Light may be, in certain special cases, a decisive factor in the formation or non formation of pycnidia, which cannot be formed in the dark. The formation of fruiting bodies begun in the full light may, however, continue even in the absence of light though with a limited intensity.

There is therefore an inverse relation between growth and reproduction, inasmuch as a strong light inhibits the normal development of mycelium.

The pycnidia form regularly at temperatures between 10° C. and 30° C. at 60° C. the formation of pycnidia ceases, while that of mycelium continues though with checked vegetative growth.

Effect of temperature.

Temperature	How obtained	Number of pycnidia	Increase in growth
6 - 6 1/2° C	Constant temperature ice box with glass doors	—	Slight
10 - 12°	Located at window in cold hallway	1 - 10	Fair (2)
20 - 22°	Room temperature near window	1 - 10	Strong
23°	Constant temperature incubator, outer door open, glass door closed	—	Weak
33°	Constant temperature incubator, outer door open, glass door closed	—	Weak

(1) Pycnidia began to form after a week.

The absence of pycnidia in the 23° and 33° C. incubators, which is in seeming contradiction to the production of pycnidia in the summer time was doubtless due to the fact that during the experiment, either the light was too much reduced or the air was depleted of oxygen.

Oxygen is indispensable both for the growth of mycelium and for reproduction. Open and sealed flasks of different sizes were used for the experiment, and from the results obtained it seems safe to conclude that an insufficient supply of oxygen causes the suppression both of growth and reproduction. In two cases only, pycnidium production took place in the sealed flasks, the fructification occurring in the larger flasks of the series.

Humidity merely delays, but does not suppress pycnidium formation, while it is at the same time favourable to the growth of mycelium.

of humidity: Test with corn brot and 100 gals. (Time 30 days).

No. of	Number of pycnidia					Growth				
	Un- germinated	Wet	Mostly wet	Mostly dry	Dry	Very retarded	Wet	Mostly wet	Mostly dry	Dry
1000	—	—	—	—	1-10	25-50	100%	Abundant	Abundant	Mod- erate

A minimum quantity of food is sufficient for growth, while a slightly larger amount is necessary for pycnidium formation, the amount contained in distilled water being enough. On the other hand, the organism will develop on an extremely rich and concentrated medium, while the formation of pycnidia ceases when the sugar solution is above 1 M 100.

Very weak solutions of magnesium sulphate and potassium acid phosphate furnish the mineral elements necessary for the growth and reproduction of this fungus, and in combination with maltose and asparagin constitute an excellent culture medium (synthetic solution) which retains the infection necessary for pycnidium formation till the close of the growing season. An extensive bibliography follows.

A New Method of Selecting Tomatoes for Resistance to the Wilt Disease.—L. H. C. W. in *Schme*, New Series, Vol. XLII, No. 100, pp. 112-114, Lancaster, Pa., 1913.

Perhaps the most serious disease of tomatoes in the southern United States is that caused by *Fusarium lyopersici*, commonly known as the potato wilt. The fungus lives in the soil and attacks the plants through the roots, later growing up through the fibrovascular bundles into the stems. In this, as in similar diseases, the only practical method of control now known is in the use of varieties or strains that are resistant to the disease. By saving seed from healthy plants in a badly infected field several seasons, strains can be obtained which show considerable resistance to the disease. This method has, however, several drawbacks: 1) many of the plants in the field do not come in contact with the wilt fungus during the season and so do not have a chance to show whether they are resistant to the disease; 2) resistant plants in the field are readily eliminated by the susceptible plants; 3) the time necessary to obtain a resistant strain is too long.

To avoid all these drawbacks, the writer has tried to improve on the old method by selecting resistant plants from the seed bed.

In ordinary sterilized soil, even if it is heavily inoculated with the potato wilt fungus, not many of the plants will show the wilt to any extent because it is time to place them in the field. The presence of bacteria and other fungi seems to have an inhibitory effect on the wilt fungus. However, the soil is first sterilized by heat and then heavily inoculated with the wilt fungus just before planting, the disease will develop so well that all the plants will be attacked and the most susceptible will be killed

before they are large enough to be placed in the field. This guarantees the degree of resistance of the surviving plants which are placed in the field.

To show how this method works in practice, results of some experiments may be briefly given. Having by the old method of selection obtained a strain that showed considerable resistance to the wilt disease, this was compared by the seed bed method with three standard varieties of wheat. The seeds of each variety were planted side by side in reinoculated seed bed soil. Different cultures of the fungus from different localities were used in order to see if they would affect the varieties differently. The following table are given the percentage of living plants and of healthy plants of each variety 68 days after planting.

Variety	Culture A		Culture B		Culture C		Cultures A, B, and C
	Living percent	Healthy percent	Living percent	Healthy percent	Living percent	Healthy percent	Living percent
"Stone"	33.3	11.8	75.0	53.0	44.7	25.5	71.1
"Acme"	11.3	0.0	42.0	28.0	31.3	21.0	13.8
"Earlimark"	32.3	3.2	63.5	36.5	37.3	17.7	60.0
Wilt-resistant	62.5	31.3	81.8	56.8	68.2	34.1	65.1

This table shows the comparatively greater resistance of the wilt-resistant variety as compared to the others, and it also shows the percentage of susceptible plants that could be eliminated before sowing in the field.

574 - **Experiments on the Treatment of Cereal Seeds for the Control of "Bunt" and "Smut" and also for keeping off Birds** (1). - MALPEAUX O. in *Journal d'Agriculture pratique*, Year 80, New Series, Vol. 29, pp. 98-99, Paris, March 24, 1916.

Experiments have been carried out at the Agricultural School of Calais during 1914, for the purpose of discovering the best disinfectants for the seeds of wheat and oats, against "Bunt" (*Tilletia*) and "Smut" (*Ustilago*).

The percentage of germination of the seeds subjected to different treatments can be seen from the following table. Many commercial products are recommended for keeping off birds ("Corbeauline" etc.), but these are best prepared on the farm with TÉTARD'S formula. To 1.32 galls of heated mineral tar add, stirring continually, 0.66 galls of phenol and 0.22 galls of petroleum; 0.22 galls of this solution is sufficient for 2 $\frac{2}{3}$ bushels of grain over which powdered lime or rock phosphate should afterwards be scattered in order to dry it.

(1) See B., Oct. 4, 1915, No. 1095.

The following table gives the results of experiments:

Percentage of seed germinated after different periods								
		0 days	7 days	8 days	9 days	10 days	11 days	12 days
<i>Wheat.</i>								
Control	88	0.0	0.1	0.0	0.0	0.8	0.0	
Cuphosphate, 0.8 %	84	80	0.0	0.1	0.4	0.8	0.8	
" 1 %	55	73	0	8	0.0	0.1	0.1	
" 1 % in contact for 10 hours	65	0.0	0	84	0.2	0.1	0.1	
" and lime	85	0.0	0.1	0.1	0.0	0.8	0.8	
" and starch	78	0.1	0.1	0.1	0	0.8	0.8	
" with starch and lime	78	7.0	8.1	0.2	0.2	0.1	0.0	
Hydric (1 in 400)	28	0.0	3.1	8.1	0.0	0	0.8	
Hydric, per gall.	7.1	8.1	8	0.1	0.1	0.1	0.1	
Formic acid (1.12 to 1.28 ozs. per gall.)	0.2	0.2	0.0	0.0	0.8	0.8	0.8	
Formic acid	—	—	1.0	1.3	1.8	0.2	0.0	
<i>Oats.</i>								
Control	0.1	0.2	0.2	0.0	0.0	0.8	0.8	
Cuphosphate, 0.8 %	0.2	0.3	0.3	0.0	0.1	0	0	
" 1 %	0.1	0.3	0.1	0.0	0.0	0	0.0	
" 1 % in contact for 16 hours	80	8.1	8.7	0.3	0.1	0.1	0.0	
" and lime	80	0.1	0.1	0.1	0.0	0.3	0.1	
" and starch	0.1	0.3	0.1	0.1	0.0	0.8	0.0	
" with starch and lime	7.3	7.0	8.0	0.0	0.1	0.1	0.1	
Hydric	85	8.3	8.1	0.1	0.1	0.1	0.1	
Hydric	80	88	0.2	0.2	0.1	0.1	0.1	
Formic acid (as above)	0.2	0.1	0.0	0.0	0	0.1	0.1	

Treatment with solutions of copper salts diminish the germinating ability of the seed, the action increasing with the concentration of the solution and with the length of its action. In practice, however, copper treatment is not very harmful to the future development of the seed for the highest loss in germinating power was 6 per cent for wheat and 7 per cent for oats. The treatment appears to reduce the energy of germination, the seeds are all slower in germinating the stronger the copper solution is.

Solutions containing tar, used for keeping off birds, diminish the germinating power and retard the sprouting of the young plants. In this case, the remedy is probably worse than the evil, for risks are much diminished by the rapid germination of the seed.

Notwithstanding the disadvantages of the copper treatment the author considers it preferable to other treatments, provided it be followed by application of powdered lime which diminishes the harmfulness of the copper salt.

- 575 **Experiments on the Prevention of *Ustilago Avenae*.** — LIND, J. in *Plantsof*, Vol. 22, p. 157-175. Copenhagen, 1915.

Ustilago Avenae (Pers.) Jensen is very common in Denmark on *A. sativa*, but it is by no means equally prevalent every year and its appearance would seem to be largely dependent on weather conditions. If oats are sown so early that the temperature of the ground is below 4°C , the resultant crop will be practically free from blight. Experiments have demonstrated that the blight can be killed entirely, without any injury to germination of the seed, either 1) by immersing the seed twenty times in the course of five minutes in water at a temperature of 55.5°C , or 2) sprinkling every 100 lbs. of oats with 10 lbs. of a solution of 0.2 per cent formaldehyde, covering it well, and letting it remain about twelve hours.

- 576 **Control Experiments against *Ustilago bromivora* and *Ustilago perennans*.** — LIND, J. in *Tidskrift for Plantsof*, Vol. 22, pp. 179-192. Copenhagen, 1915.

Ustilago bromivora is common in Denmark on *Bromus arvensis*, *B. mutatus* and *B. hordeaceus*; abroad it is found on *B. arvensis*, *B. distachys*, *B. ciliatus*, *B. fasciculatus*, *B. lanceolatus*, *B. longiflorus*, *B. maritimus*, *B. macrostachys*, *B. madritensis*, *B. marginatus*, *B. maximus*, *B. rubens*, *B. scaberrimus*, *B. sterilis*, *B. unioloides* and *B. villosus* in all parts of the world; it has not yet been decided if it is a single species or if it can be divided into separate biological forms. Experiments have demonstrated that the fungus can be destroyed without affecting the growing properties of the seed in the five following ways: 1) By soaking the seed in water for three hours, letting it remain in the wet sacks for ten hours, and then dipping it twenty times in the course of five minutes in water at a temperature of 50° - 51°C . 2) By dipping the dry seed twenty times in five minutes in water at a temperature of 54° - 55°C . 3) Soaking in a solution of 0.2 per cent formaldehyde for six hours. 4) Soaking in a 0.1 per cent solution of formaldehyde for six hours. 5) Spraying each 100 lbs. of seed with 6 lbs. of a 0.1 per cent solution of formaldehyde whilst stirring vigorously, covering for twelve hours and then drying by hot air at a temperature of 80°C .

Ustilago perennans is only found on *Avena sativa*; it is controlled by the means above specified.

- 577 **Sulphur-lime Mixture as a Substitute for Bordeaux Mixture in Controlling certain Fungi Parasitic on Fruit Trees.** — SIVASANO L. in *R. Stazione di Agricoltura e Frutticoltura*, Bollettino No. 22, pp. 1-4. Agrigola, February 1917.

According to experiments made in Italy and elsewhere, the sulphur-lime mixture may replace the copper-lime mixture in the following cases:

- 1) "*Brusone*" or "*Apple-leaf-spot*". — All Pomaceae attacked by *Fusicladium pirinum* Fuck. and *F. dendriticum* Fuck. The parasites are controlled by means of two successive sprayings with a sulphur-lime mixture having a density of 1.25. The first, or winter spray-

strength is repeated if the orchard has been badly attacked by the parasite; and the second spraying of 5% strength is done after the petals fall. The parasite is controlled by the first spraying while it hibernates on the trunk or branches, while the second treatment controls its attacks on the leaves and fruit. This second treatment may be followed by a third and even a fourth when the weather is damp. The summer treatments must be done carefully, for they easily cause scorching of the leaves.

2) "*Bozzacchioni*" or "*Erioseus seedlings on Drupaceae*".

Amongst Drupaceae, the peach tree is the most attacked by *Erioseus rosarum* Fuck; next follows the plum tree attacked by *E. pruni* Fuck. The life history of these parasites suggests two separate sprayings; the first with an 8% solution when the buds begin to swell, and the second with a 5% solution after the shedding of the petals. In rainy weather, a third spraying of 5% strength may prove useful. It may be noted that with such trees a slight scorching of the leaves cannot be avoided.

3) "*Occhio di pavone dell'olivo*" - *Cycloniu oleaginum*. For this parasite the sulphur-lime mixture may be used. If the parasite remains on the tree during the winter, a spraying in this season may be done with a 5% solution. After the shedding of the flowers, two or three sprayings at 1% according to the conditions of the season, may be applied when the parasite first appears.

Besides being used against cryptogamous diseases, the sulphur-lime mixture may be used against Acari, Aphides and Scale-insects (*Chrysomela dictyospermi* Mask.). In these cases, this mixture may be applied instead of the copper-lime mixture which is three times more costly.

4 - A Fungus of Uncertain Systematic Position occurring on Wheat and Rye in the Salt Lake Valley. — O' GARA P. J., in *Science*, New Series, Vol. XLIII, No. 1099, pp. 111-112, Lancaster, Pa., January 21, 1916.

For some time the writer has been studying a very interesting organism which has been found occurring on wheat and rye in the Salt Lake Valley. The fungus seems to attack the heads of both wheat and rye some time before they emerge from the sheaths. Very often the heads are so severely attacked that they do not emerge, but remain permanently within the sheath. The fungus is usually found on the rachis, the glumes, the essential organs and the inner parts of the sheaths. The effect upon the inflorescence seems to be such as to prevent the normal development of the essential organs.

The writer was able to isolate the specific agent, a fungus having a bite or hyaline mycelium. Perithecia-like bodies are borne on either short or long stalks on the mycelium or they may be borne terminally.

In some respects this fungus bears a striking resemblance to *Endoascus mali* Lewis. However, no sporidia are produced and the perithecia-like bodies do not contain germinating ascospores.

579—**A *Phoma* Disease of Western Wheat grass in Salt Lake Valley** (115—117), in *Science*, New Series, Vol. XLIII, No. 1099, pp. 110-111, Lancaster, Pa., January 1916.

During the summer of 1915, specimens of Western wheat-grass, *Andropogon smithii* Rydb., a very important forage plant in Salt Lake Valley, were collected in that region. On the plants was found a *Phoma* which did not seem to have been previously recorded as occurring on *A. smithii*. A considerable number of species of *Phoma* have been found on Gramineae, but many of them are imperfectly described, so that it is difficult to say whether the species of *Phoma* occurring on Western wheat grass is or is not new.

In some respects it resembles *Phoma lophiostomoides* Sacc., although the spores are smaller, being as a rule less than 15 μ in length. Owing to the small size of the spores and other prominent characters on which the writer will publish later a more extended note, it is possible that the species is new.

580—***Monilochaetes infuscans* (Sweet Potato Scurf) Injurious to Sweet Potatoes**—HARTER L. L., in *Journal of Agricultural Research*, Vol. V, No. 17, pp. 787-791, U. S. Dept. of Agriculture, Washington, D. C., January 24, 1916.

The sweet potato scurf disease is characterised by a brown discoloration of the surface of the underground parts of the sweet potato. The discoloured areas may occur as spots of varying size with no definite outline, or as a uniform rusting of the entire surface.

Although the infection is very superficial and produces no rupture of the epidermis, scurfy potatoes do not command as high a price in the markets as do clean ones. The fungus, under favourable conditions such as a relatively high humidity and temperature, continues to develop in storage, and besides rendering the potatoes unfit for sale, makes them at the same time less resistant to the attacks of other parasites.

Scurf is more prevalent in heavy, black soils and in soils that have been heavily manured or contain a large amount of organic matter, than in light sandy soils. The writer found the scurf very prevalent on sweet potatoes in New Jersey, Delaware, Maryland, Virginia, North Carolina, Ohio, Illinois, Iowa and Kansas, and to a slight extent in other States. The following varieties are susceptible to scurf in varying degrees: Edgemoor Sugar Yam, General Grant Vineless, Florida, Nancy Hall, Yellow Yam, Miles Yam, Red Brazilian, Dahomey, Yellow Strasburg, Pierson, Kew West Yam, Vineless Yam, Southern Queen, Big Stem Jersey, Yellow Jersey and Early Carolina.

The scurf disease of the sweet potato was first recognised in 1860 by Halsted, who named the fungus "*Monilochaetes infuscans*", a new genus and species. He failed, however, to describe either the genus or species. The writer has isolated the organism and shown by inoculation experiments that it is the true cause of the disease. After a detailed description

(1) See B. February 1916, No. 242.

point out that although the organism on the host consisted merely of sporophores and conidia, in culture well-defined branched mycelia and spores developed.

4. **Further Studies on Peanut Leafspot (*Cercospora personata*), Injurious to the Leaves of *Arachis hypogaea*.**—WOLFF FRIEDRICH A. in *Journal of Agricultural Research*, Vol. V, No. 10, pp. 501-602, Washington D. C., February 1, 1916.

Researches have been conducted in Alabama in order to determine: 1) the efficacy of rotation and seed treatment in the control of leaf spot, *Cercospora personata* (B. and C.) Ellis, which causes spots on the leaves of *Arachis hypogaea*; 2) the correlation between the destructiveness of the disease and the presence of certain climatic conditions; 3) the agencies concerned in the distribution of leafspot.

The following results were obtained:—

1) Rotation by itself is not effective under field conditions in diminishing leafspot, as shown by a field in which peanuts had not been grown for 2 years and in which 95 per cent of the plants were diseased by August 31, with an estimated loss in yield of 14.5 per cent; the germs of the fungus continue to develop and spread in the soil even in the absence of the host plant, so that seed disinfection with copper sulphate or formaldehyde before planting does not prevent leaf spot. Neither does shelling peanuts before planting to eliminate the danger of infection from conidia, prevent the disease; 2) An approximation of the total leafspot area involved by *Cercospora personata* showed that the photosynthetic area had been decreased 35.07 per cent. Estimation of decrease in yield of peas of from 5 to 10 per cent as the result of leafspot are therefore regarded as reasonable.

No correlation between the presence of certain conditions of temperature and moisture, and the prevalence of leafspot exists; 3) the wind largely contributes to the dispersion of the fungus; as the results of 216 glycerin exposure-plate tests made in different parts of Alabama it is concluded that *Cercospora personata* is wind-borne. Seventy-eight of these 216 exposure plates gave positive results. At no time from August 6 to August 26 was there a period of maximum spore dispersal as revealed by the exposure plates; 5) Many insects are disseminators of the leafspot fungus, either by carrying conidia on the surface of their bodies or by voiding conidia in their faeces, the vitality of the fungus being in no way diminished; of 75 insects belonging to the orders Orthoptera, Lepidoptera, Coleoptera, and Hemiptera, collected in 5 different localities, 54 gave positive results.

5. **Brown Blight of Tea (*Colletotrichium Camelliae*) in India.**—MURRAY W. AND ANSTEAD RUDOLPH D. in *The Pioneer's Chronicle*, Vol. XL, No. 1, pp. 1-4, Bangalore, February 1, 1916.

Colletotrichium Camelliae has recently become prevalent on Tea plantations in the neighbourhood of the Nilgiri Wynand and Wynand district and it has caused more damage than usual, causing defoliation and weakening the whole plant. The fungus has also been noted in two instances on nurseries, where it does a considerable amount of damage.

Brown blight has been reported from Assam, Dajpeling, and Ceylon,

and also from Tea growing districts in other parts of the world. In all the districts of southern India visited by the writers, this disease is present. The following recommendations for the control of the disease are suggested:

1) In nurseries: As soon as the disease appears, all attacked leaves should be picked off and burned and the plants then sprayed with Bordeaux Mixture. The plants should then be watched, and on any signs of the disease reappearing, a second spraying should be given. All dead and dying plants as well as fallen leaves on the ground should be removed and burned. Slaked lime should be sprinkled on the ground surface of the beds and lightly worked in. The nurseries should be kept as open to light and air and as dry as is consistent with the wellbeing of the plants. Watering should be very carefully done and only when absolutely necessary in order to avoid too moist conditions and a damp atmosphere favourable to the growth of the fungus. The surroundings of the nursery should be freed from weeds and jungle and kept as open to the sunlight as possible.

2) In old Tea: When the old Tea is not badly attacked, it is best not to do anything until pruning time. Where the Tea is attacked all pruning should be burned and all fallen and dead leaves should, as far as possible, be collected and burned. Slaked lime should be broadcasted at the rate of 5 cwt. per acre and forked in so as to bury any refuse that may be left and to clean up the fields. Manures which tend to produce a rapid growth of sappy wood and abundance of leaves, such as nitrates, nitrolime, etc., should be avoided on areas liable to the attack of the fungus. Nitrogen, if needed, should be supplied in the form of organic manure such as Cattle manure, Poomas, Fish, etc., or better still green dressing such as Dadap. Manures which tend to produce hard wood should be used, such as Phosphates and Potash, and mixtures of Basic Slag, Basic Superphosphate, or Epsom phosphates, with Sulphate of Potash. Wood Ashes might replace the potash for the present.

583 - *Oidium quercus* on Chestnut Trees in Italy (1). — TROTTER A. in *Entomol. Series II*, Year III, No. 2, pp. 49-53. Florence, February 1916.

In opposition to BUREAU's assertion that the chestnut tree is not susceptible to the attack of "*Oidium quercus*", the writer was able to verify with certainty on September 17, 1915, a case of intense infection of the new sprouts growing from the stocks of old chestnut trees felled in the neighbourhood of Vittorio Veneto on the slopes of Mount Pizzoc.

In 1910, FARNETI had already alluded to the presence of "*Oidium*" on chestnut trees in the vicinity of Savona.

Besides the oak, this fungus therefore attacks the chestnut, and also the beech tree in Italy, as FARNETI reports from the Bolognese Apennines in 1910. The field of observation is thus, according to the writer, much broadened as regards the affinity of "*Oidium quercus*" with its aspen

(1) Concerning this disease see *B. Nov.* 1910, p. 181; *B. Dec.* 1910, pp. 357, 404 and 411; *B. March* 1911, No. 998; *B. April* 1911, No. 1298; *B. June* 1911, No. 1892; *B. March* 1912, No. 577; *B. May* 1912, No. 852; *B. Dec.* 1913, No. 1395; *B. Jan.* 1914, No. 75; *B. Dec.* 1914, No. 1184.

weaving form which may therefore be searched for, not only on the exotic representatives of the genus *Quercus*, but also on those of the genera *Castanea* (incl. *Pasania*) and *Fagus* (incl. *Nothofagus*), if its identity with *Microsphaera verrucosa* Schw. or *M. alphitoides* Griff. and Manbl. be not accepted. Although the writer closely examined the locality, he was unable to find other centres of infection, and came to the conclusion that the stocks which produced the infected sprouts must have been in very special conditions.

In fact, the virulence of the sudden attack was explained by the circumstance that the trees in question were felled for urgent reasons, quite out of season, and between the 7th and 16th of July. There is no doubt that the new shoots, weaker because of the season and the altitude, could not have sprouted sooner than the middle of August, developing with difficulty and consequently being in a highly receptive condition. On the other hand, the "Oidium" is at that time in its most active phase of sporulating and consequent infectiousness. Therefore, while the specific receptivity shown by the chestnut is to be feared — all the more that in many regions, especially of the Apennine, the felling of the chestnut woods is one of the most extensive and remunerative forms of culture the circumstance above noted allows of the hope that when the trees are not felled out of season they may remain practically immune from infection.

184 - *Polyporus Schweinitzii* injurious to Conifers in Great Britain. — MURRAY J. M. in *Transactions of the Royal Scottish Horticultural Society*, Vol. XXX, Part I, pp. 56-57, Pl. VII, Edinburgh, January 1916.

Polyporus Schweinitzii Fr. has hitherto been regarded as a rare species in Britain, but it would now seem to be becoming much more common, and may yet have to be looked upon as a great danger to coniferous forests. It attacks Douglas fir and Sitka spruce in Perthshire, and Scots pine in Midlothian. It has also been recorded on larch in England. The rot produced is rather characteristic. At first the wood becomes dull-yellow, later it changes to dark brown. Here and there, small white patches or pockets of mycelium may be seen. The whole mass becomes brittle, very light, and is broken up by many fissures. The decaying wood has a turpentine-like odour.

The following remedial and preventive measures are suggested: 1) Cut out affected roots well above the place where the last sign of rot appears, and bar the wound; 2) Collect and burn sporophores while young; 3) Cut out badly attacked trees and plant hardwoods in their place.

185 - A serious Disease in Forest Nurseries caused by *Peridermium filamentosum* (1). — WEIR JAMES R. and HUBERT E. BENTON in *Journal of Agricultural Research*, Vol. V, No. 17, pp. 781-785, Washington, D. C. January 21, 1916.

In June 1914, several seedlings of *Pinus ponderosa* Laws., with the stems severely infected with a disease caused by a species of *Peridermium*, were received from the Savenac nursery of the United States Forest Service at Hangan, Mont.

(1) See, *B.*, February 1916, No. 251.

On July 2, 1914, *Castilleja miniata* Dougl., growing in abundance at the nursery site, was found bearing the fungus *Cronartium coleosporioides* (D. and H.) Arthur. No other species of *Cronartium* was found and it seemed certain that the fungus on the pine seedlings could be no other than *Peridermium filamentosum* Peck., the acedial stage of *Cronartium coleosporioides*. On May 1, 1915, all of the two-year-old yellow pine seedling beds were found to be infected with the fungus. Most of the infections were found along the north and east borders of the seedling beds. A large patch of *Castilleja miniata* was growing on the edge of a lodge-pole pine (*Pinus murrayana* "Oreg. Com.") stand near the creek bank directly northeast of the infected seedling beds. The winds prevalent in the region blow both northeast and southwest, which is an important factor in the distribution between the two hosts; the acediospores from the infected yellow pine being thus distributed to the *Castilleja* plants and the spores borne on the *castilleja* leaves are transmitted to the young trees in the beds. Towards the middle of May, this fungus infection was found to be of serious importance on the yellow pine. From fresh specimens of the blister rust, two plants of *Castilleja miniata* were inoculated on May 3, 1915. On May 2,uredospores developed on the underside of the leaves; later the teliospores developed, sporidia being produced on May 29. Duplicate experiments were conducted at the field camp at Priest River, Idaho, with positive results. The characteristic filamentous structure of the acedidia on yellow pine seedlings and the transfer of the fungus to *castilleja* plants proved the fungus to be *Peridermium filamentosum* Peck. In May 1915, the yellow lodgepole pine surrounding the nursery was found to be infected by *Peridermium* on the trunk, as well on the branches and needles.

The trunk form (known locally as the "hip canker") and the branch-gall form have been referred to *Peridermium cerebrum* Peck by ARTHUR and KERN. Experiments carried out, prove that the "hip canker" and the gall-forming *Peridermium* of the lodgepole pine are both *Peridermium filamentosum*.

On May 17, 1915, acediospores from the "hip canker" of *Pinus contorta*, were sown on two plants of *Castilleja miniata*. On June 3 teliospores were present on the leaves. The teliospores appeared on June 14. The *Cronartium* was identical with that previously produced by the inoculations on *Castilleja miniata* with acediospores from the *Peridermium* on the 2 year-old seedlings of *Pinus ponderosa*. This demonstrates the identity of the "hip canker" *Peridermium* with *Peridermium filamentosum*.

The same may be said for the "branch-gall" of *P. contorta*; acediospores from the gall-forming *Peridermium* on branches of lodgepole pine sown by the writers on plants of *Castilleja miniata*, gave origin in 1915 to cases of *Cronartium coleosporioides*. *Peridermium stalactiforme* A. and K. which causes the blister rust of *P. contorta* is also identical with *Peridermium filamentosum*.

The absence of oaks (*Quercus* spp.) the alternate hosts of *Peridermium nesioides* and *P. cerebrum* confirms all that has hitherto been said.

The yellow pine seedlings in the nursery were free from trauma

ities. It is safe to draw the conclusion, therefore, that the spore tubes which produce the infections in the seedlings penetrate the host in the absence of all surface openings due to mechanical injuries. The period of development between the time of penetration of the host and the appearance of the acedial eruptions on the stems is about 10 to 11 months. The ageing spores could have been either sporidia from the species of *Crocodragium* on *Castilleja miniata* or possibly acidiospores from the surrounding lodgepole pines infected with *Peridermium filamentosum*. In June 1915 survey was made in the surrounding area of Savenae nursery for a distance of half a mile. Fifty per cent of the lodgepole pine stand in close proximity to the beds was badly infected with *P. filamentosum*. *Castilleja miniata* was found growing in abundance under the trees.

Experiments are being tried in order to control the disease; the following measures may be advised:

- 1) spraying the seedlings in the nursery beds with the usual fungicide during the infection period;
- 2) eradicating and destroying all infected material;
- 3) felling and burning the alternate host trees in the neighbourhood of the nurseries.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS

Orobanche ramosa and *O. cumana* Parasites of Tobacco in Roumania

GRINTESCO I, in *Directiunea Generala a Recluziunilor Monopoliare Statului* (Bulletin, Year II, Part I-1, pp. 10-31, Figs. 6, 14, 2; Year III, Part 1-2, pp. 1-28, Figs. 1-11, and Part 3-4, pp. 20-23, Bukarest, 1915-1916).

Amongst the numerous foes of tobacco existing in Roumania, the *Orobanchaceae* hold the first place both for the vast amount of harm they do and for the rapidity with which they spread.

The species known in that region are two: *Phelipaea ramosa* C.A. Mey. (= *Orobanche ramosa* L.) and *Orobanche cumana* Wallr., the last being for the first time reported as a parasite of tobacco in Roumania. *Phelipaea ramosa*, commonly known by the names of "Lapoae" "Cumana tanului" and "Cicee", appears about the end of June, and exceptionally, when the season happens to be very rainy and damp, in the second half of July or the first half of August. It may be said to spread over the whole of Roumania having been reported from: Zerbinit, Odobesti, Itricanu, (Neamtin), communes of Macea and Braila, Bivolari (Iasi) Caldasani (Greci), Macin, and is very frequent in the northern districts of Dobruja.

There are, however, two large separate centres of infection, one in North Dobruja, the other in Moldavia in the district of Priponesti-Tutova. Besides tobacco, this *Phelipaea* attacks numerous other cultivated and

(1) See B. June 1911, No. 1038, and B. June 1914, No. 577.

wild plants : hemp, *Cucurbita Pepo*, potato, etc. It is reported for the first time in Roumania as a parasite of *Filago arvensis*, *Veronica officinalis*, *Cucurbita Pepo* at Suluk (Macin) and near the monastery of Cocos (Târgu Orobanche *cumana* Wallr., a plant but little known in Roumania) : spread from the south of Russia to Dobrugia, where the writer was able to collect several specimens attacking tobacco in the neighbourhood of Cocos.

The writer gives a long description of both the species under examination, of their varieties and sub-varieties, origin and geographical distribution, and the means of control used against these parasites.

587 - Turnip weed (*Rapistrum rugosum*, All.) in South Australia. — ANDREW H. W. in *The Journal of the Department of Agriculture of South Australia*, Vol. X, No. 5, pp. 472-475, 2 Figs. Adelaide, 1915.

Rapistrum rugosum was very prevalent in 1915 in the wheat fields of the Northern districts and elsewhere in South Australia.

As a means of control against this weed, it is advisable to allow it to be grazed by sheep who eat these cruciferous weeds and destroy the plants. Also, careful examination of agricultural seeds coming from districts infested by *Rapistrum* should be carried out.

588 - *Carrichtera annua*, a New Weed in Australia. — QUINN GEORGE ANDREW H. W. in *Journal of the Department of Agriculture of South Australia*, Vol. X, No. 4, pp. 380-383, Figs. 2. Adelaide, 1915.

In August 1915 a new plant belonging to the cabbage or mustard family (*Cruciferae*) and submitted to the Agricultural Department was identified as *Carrichtera annua* (L.) Prantl, which has not previously been recorded as growing in Australia. The plant was not noticeable more than a couple of years ago, but now extends over 100 to 200 acres in the neighbourhood of Port Pirie (South Australia). This plant, if not exterminated in the near future, is likely to become very widespread and cause much trouble. Steps must therefore be taken to eradicate or restrain this weed by the local authorities, or private individuals, on whose land it may be found growing.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

589 - Some Injurious Indian Weevils (*Curculionidae*). — MARSHALL GUY A. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 365-376, Figs. 1-5. London, February 1916.

Six new species of *Curculionidae* injurious to cultivated plants, are reported from India :

1) *Emperorrhinus defoliator*, in the following districts : (Punjab) Chawai, Kulu, Kangra ; (Sikkim) Kurseong, Darjiling ; (Assam) Khasi Hills. It destroys the foliage of the alder (*Alnus nitida*), peach, apricot, pear, apple and cherry. 2) *Coniatulus indicus* at Pusa (Bengal) injurious to *Taraxacum indica*. 3) *Ceuthorrhynchus portulacae* the larvae of which damage :

aves of purslane (*Portulaca oleracea*) at Pusa. 4) *Baris portulacae* damages the same plant by boring the stems, also at Pusa. 5) *Athesapelta oryzae* attacks rice at Coimbatore, Pithapuram, Godavari (Madras). 6) *Leptocryptus citrulli*, a pest of water melons, at Coimbatore (Madras), Hadagalli and Hagari (Bellary District) and Koilpatti (Tinnevely District).

13. **Insects Injurious to Cultivated Plants in the Nyassaland Protectorate** (14). MAXSON C. in *Nyassaland Protectorate, Annual Report of the Department of Agriculture for the year ending 31st March, 1915*, pp. 30-40. Zomba, Nyassaland, 1915.

COTTON. — Among Coleoptera the following may be mentioned: 1) one or more species of the family of *Scarabaeidae*, especially *Plaesiorhina trivittata* Sch., which eats the pods; 2) a Tenebrionid not yet identified, discovered in large numbers at Nyachiperi and Namiwawa, where it injures the leaves; 3) *Ootheca mutabilis* Sahlb. (Linn. *Chrysomelidae*) which also attacks the foliage; 4) *Apion armipes* Wagn. (*Curculionidae*) which has spread with extraordinary rapidity in the plantations, destroying the bark of the plants just above the collar; after an *Apion* attack an invasion of white ants generally follows causing the final destruction of the plants. Uprooting and destroying all infected plants is the best means of control.

Among the Lepidoptera are: 1) *Diparopsis castanea* Hampn. ("red boll-worm"); 2) *Chloridea obsoleta* F. ("American boll-worm") which, besides cotton, attacks *Cicer arietinum*, *Helianthus annuus*, hemp, corn, ground-nuts, tobacco, tomato, *Morus* spp., *Brassica* spp. and ornamental plants belonging to the genera *Solanum*, *Geranium* and *Hibiscus*; 3) *Prodenia litura* F., abundant during February and March; 4) *Earias insulana* Boisdu., which also destroys the leaves and shoots of *Hibiscus* and is often found in the pupal stage in the trunks of *Eriodendron*, which may thus be numbered among the host plants of this moth; a Braconid, *Rhogas* (?) is reported to be a parasite of *Earias*; 5) *Sylepta derogata* F. ("cotton leaf-roller"), abounding in the regions S. E. of Lake Nyassa; among its natural enemies are two Chalcids, some Braconids, and an Eumenid; 6) *Tortrix* sp. ("cotton shoot webber"; 7) *Acrocercops bifasciata* Whitt. (?) "cotton leaf-miner"; 8) *Hypolymnas misippus* Linn.; 9) *Calopsilia* sp.; 10) *Acantha graellsii* Feisth.; 11) *Ophiura* sp., which attacks and sometimes almost completely destroys the foliage; 12) *Cosmophila crosa* Hubn.; 13) other lepidoptera not yet identified belonging to the families *Noctuidae*, *Lymntriidae*, and *Geometridae*.

Among the Hemiptera are mentioned: 1) *Dysdercus nigrofasciatus* Stal. and *D. intermedius* Dist., common especially on the river banks of the plateau; they cause the pods to fall off, premature flowering and various other anomalies in growth and development; 2) *Oxycaenus hyalinipennis* (?), common in the districts of Port Herald and Mpimbe; 3) *Anoplocnemis curvipes* F., which has as host plants, besides cotton, also *Helianthus*, *Dahlia*, *Hibiscus*, Mango, *Ficus* sp., *Brachystegia* sp. and many

(F. L.).

*1 See B. July 1914, No. 690.

annual or perennial Leguminosae; 4) a representative of the *Mentzeliae*; 5) a species of *Jassidae*; 6) *Aphis gossypii* Glover etc.

TOBACCO. — This plant does not in general suffer much from insect attacks; the following may, however be recorded: 1) *Prodenia litura* F., which also attacks cotton, as has been already mentioned; as control the arsenate of lead treatment is advised and also the collection and destruction of larvae and eggs; amongst the natural enemies, besides the insect parasites already known, is also a bird, *Corvus scapularis* Dand. which destroys a considerable number both of larvae and adults; the writer was able to examine the stomach contents of two of these birds and found in one of them 7 larvae of *Prodenia litura*, 23 specimens of *Termes bellicosus* Linn. and 1 species of *Carabidae*; in the other, 2 specimens of *Gastromargus* (?), 13 *Termes bellicosus*, 11 *Prodenia litura*; 2) *Phthorimaea heliopa* Linn. ("tobacco stem caterpillar"); for which it is advisable to destroy all the infected seedlings in the nurseries, 3) *Lasioderma serricorne* F.; 4) *Agrotis* sp. ("cutworms"); 5) *Hippotion celerio* Linn.

MAIZE. — Is attacked by: 1) larvae of *Busseola fusca* Hamp (?) that penetrate into the thickness of the cob, boring long galleries through it; the plants thus attacked wither and break off very easily at the least touch or breath of wind; these larvae appear very late, when the maize is almost ripe, so that the damage is not extensive; the late varieties are thus more subject to injury than the early varieties; as control, it is well to remove all vegetable refuse from the infested fields and to introduce the practice as yet not applied in these regions of topping the plants 2) *Chloridea obsoleta* F., *Cirphis loreyi* Dnp. (?) *Eublemma* sp. injurious to the flower, cause lesions that open the way for other insect attacks or for cryptogamic infections, etc.; 3) *Elaeum erythrocephalus* Oliv. (?); 4) *Arctiidae*, *Lymantriidae* and larvae of *Catopsilia* sp. damage the leaves.

OTHER CEREALS. — Wheat, barley, oats and rye have been injured by white ants, and in the district of Fort Johnston, a swarming of locusts has occurred in the wheat fields.

MUSTARD. — At Namiwawa this plant has been attacked first by the larvae of *Athalia* sp., then by *Aphis* sp. and finally by a bacterial disease that completely destroyed the crop.

HELIANTHUS. — Is attacked by *Anoplocnemis curvipes* F. but with slight damage. It may be useful to plant many specimens of *Helianthus* in the cotton fields, as *Anoplocnemis* may be attracted to these plants for which it shows a marked preference, and abandon the cotton. *Chloris arietinum* a favourite plant of *Chloridea obsoleta*, another enemy of cotton, might be used similarly.

MANGO, PEACH, PINEAPPLE. — Have been attacked by *Drosophilidae* that feed on the unripe fruit; some *Scarabaeidae* eat the ripening fruit of peach, especially *Plaesioorrhina trivittata* Sch.

MULBERRY. — Two species of scale insects attack this crop: *Diaspidiotus pentagona* Targ. which has for natural foes in Nyassaland a fungus, perhaps *Macropera*, and a local species successfully controlled by two *Lepidoptera* a Pyralid and an *Eublemma*.

Khaya Senegalensis. — Special attention should be given to the larvae *Heteronygmia leucogyna* Hmps. that injure the foliage; this insect is found throughout all Nyassaland from the district of Zomba to that of Lake and must be also fairly common at Mbawa; the larvae of *Massidia agrestalis* Hmp. perforate the bark and penetrate into the zone of the album, causing large and varied excrescences on the trunk and main branches.

Report on some Coccidae from Zanzibar. — GREEN ERNEST E. in *Publication of Entomological Research*, Vol. VI, Part 1, pp. 175-186, London, February 1916.

A list comprising the following species collected by Dr W. M. Aders: *Icerya seychellarum* Westw., on *Citrus limonii*; *Asterolecanium bambusae* Bdv., on stems of large bamboo; *Pseudococcus citri* Risso, on immature cotton bolls, under the sepals; *Ps. crotonis* Green, food-plant not mentioned; *Ps. perniciosus* Newst., on Shu-shu, a Cucurbitaceous plant; *Ps. citricus* Ckll., on cotton (*Gossypium*), and on *Clitoria*; *Lecanium hesperidum* on indigenous fern; *L. viride* Green, on coffee leaves and young terminal shoots; *Pulvinaria antigoni* Green, on stem of chilies and on leaf *Luffa acutangula*; *Ceroplastes floridensis* Comst., on *Persea gratissima*; *Homocidus? africana* Macfie., on Leguminous climber; *Aspidiotus cydoniae* Sign., and *A. destructor* Degu., on husk of coconut; *A. dictyocarpus* Morgan, on stem of seedling mango; *A. ficus* Ashm., on rose stalks; *Atanidia* Sign., on husk of coconut; *A. trilobitiformis* Green, on pomelo (*Carus decumana*) leaves, indigenous fern, *Ficus elastica* and young *Citrus* trees; *Diaspis pentagona* Targ., on *Hibiscus sabdariffa* and papaw fruits (*Carica Papaya*); *Hemichionaspis minor* Mask., on husk of coconut; *Hemichionaspis* sp., near *rhododendri* Green, on sisal hemp (*Agave sisalana*); *Chionaspis longirostris* Sign. on coffee; *Lepidosaphes citricola*, Packard, on orange rind and young orange trees.

Notes on Samoan Coccidae. — DOANE R. W. and TERRIS G. I. in *Publication of Entomological Research*, Vol. VI, Part 1, pp. 196-197, (Figs. 1-6), London, February 1916.

A list of coccidae collected in Samoa including the three new species: *Gonaspis samoana* on palm trees; *Aspidiotus fangoensis*, on coconut husks; and *Lepidosaphes moorsii* on trunks of orange trees. The other species enumerated are:

Asterolecanium bambusae Bdv., very abundant on bamboo; *Coccus ventralis* (Green), *Coccus viridis* (Green), *Lecanium psidii* Green, and *Pulvinaria psidii*, Mask., on unidentified plants; *Ceroplastes rubens* Mask., extremely abundant on mango; *Saissetia nigra* (Nietn.) host not identified; *S. oleae* (Bern), common on oranges and several other plants; *S. hemisphaerica* (Targ.), on several different hosts; *Eucalymnotus tessellatus* Sign., on unidentified host; *Chionaspis citri*, Comst., very abundant on orange, *Hemichionaspis aspidistrae* (Sign.) on palm, banana and orange etc.; *Aspidiotus cydoniae* Comst., on orange and an unidentified plant; *Chrysomphalus rossi* (Mask.), on coconut husks; *Olonaspis secreta* Ckll., common on bamboo; *Lepidosaphes beckii* (Newm.), very common on orange; *L. glomerii* Pack., on orange; apparently much less common than *L. beckii*; *Parlatia cinerea* Doane and Hadden, common on orange.

- 593 - On the Existence of Two Annual Generations of the "Elm-galerucella" (*Galeruca luteola* F. Müller) and their Alternation (1). -- Lecaillon A. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 162, No. 13, pp. 1271-1272, Paris, March 27, 1916

In the region of Toulouse the "elm galerucella" lays its eggs on the under-surface of the leaves of that tree, from the first days of May to the beginning of September, that is, a period of four months. There are two successive generations each of which reproduces itself in about two months. The second generation produces a third, the hibernating one; this generation constitutes the first spring generation. But as each female lays eggs at repeated intervals during a period that may extend to one and a half months, the adults of the second generation appear before those of the first generation have finished laying their eggs, and those of the third generation before all those of the second generation have finished reproducing. It happens, therefore, that individuals of "galerucella" belonging to two different generations are found at one time on the elms. It may be possible that adults of the second generation which have not yet finished laying their eggs should hibernate and continue to reproduce in the following spring (thus forming the first generation of the successive year) and that certain adults of the third generation should commence laying their eggs before hibernating.

- 594 - Control of Injurious Aphids by Ladybirds in Tidewater, Virginia. -- FISK R. in *Virginia Truck Experiment Station, Bulletin* 15, pp. 337-350, 1918, 72-77, Norfolk, Virginia, 1915.

The control of aphids, or plant lice, by distributing ladybirds on a large scale originated in the State of California.

Shipments of ladybirds from California to Norfolk were begun in 1911. The plan was to establish colonies of ladybirds, whence they could in time spread throughout the entire truck section of Tidewater, Virginia. During 1910 to 1911 several colonies of two species of ladybirds, the spotted ladybird (*Megilla maculata*) and the convergent ladybird (*Hippodamia convergens*), were liberated, but the largest number of the convergent ladybirds was established by the writer during the years 1913 and 1914. In all, 21 colonies were distributed, making a total of nearly a million ladybirds.

The colonies were placed within five miles of each other and were usually liberated during the early spring; a colony contains approximately from 30,000 to 33,000 ladybirds.

The life of a ladybird from egg to egg is from four to six weeks. The life of a larva is about 20 days; that of the adult ladybird varies from 20 to 50 days.

The number of aphids eaten by a larva during its lifetime is about 250; by an adult, from 100 to 1,000.

There are five generations of the ladybirds in Tidewater, Virginia.

(1) See B. Oct. 1914, N. 968.

During July and August the ladybirds for the most part do not breed, and are partly inactive.

H. convergens prefers smaller, soft-bodied aphids, and is very fond of the cabbage aphid (*Aphis brassicae* L.), melon aphid (*A. gossypii* L.), spinach aphid (*Myzus persicae* Sulz.) and bean aphid (*A. rumicis* L.); when food is scarce it will feed also on other species, and does not disdain even *Macropothum rudbeckiae* Fitch, a large red species which is common on golden rod (*Rudbeckia laciniata*). In extreme cases it will feed on other sucking insects, like the egg plant lace-bug, and also on the eggs of the potato beetle, or even the pollen of certain plants, particularly maize. *M. maculata* is less discriminating and feeds on any species of aphid within reach. The first to leave for hibernating quarters is the spotted ladybird, usually about the middle of November. The convergent ladybird during mild winters may continue to feed as late as Christmas.

In California, the ladybirds hibernate during the winter in the Sierra mountains. In Tidewater, Virginia, the convergent ladybird hibernates in proximity to the feeding areas in weeds, debris, or in the ground. The spotted ladybird hibernates on trunks and stumps of oak trees.

There are very few natural enemies of the ladybirds though some birds feed on them. A large number are probably destroyed by persons unfamiliar with their utility and who mistake them for injurious species.

The ladybirds are considered valuable as checks to sporadic outbreaks of aphids. Where the ladybirds were colonized, no further serious trouble from aphids has been reported.

95 - **Natural Enemies of Sugarcane Borers in Java.** VAN DER GOOT P. in Mededeelingen van het Proefstation voor de Java Suikerindustrie, Nieuw V., pp. 125-129, 1914. Sumatra, 1915.

A catalogue and description of the natural enemies of the Sugarcane borers. Of the latter, the following species are known in Java: *Diatraea striatalis* Sn. ("Gestreepte Stengelboorder"); *Chilo infuscatellus* Sn. ("Gele Topboorder"); *Scirpophaga intacta* Sn. ("Witte Topboorder"); *Grapholita schistaceana* Sn. ("Grauwe Boorder"). The natural enemies are divided in two groups: egg-parasites, and larva-parasites; among the first, *Phanurus beneficiens* Zelnitner attacks the eggs of *Diatraea*, *Chilo* and *Scirpophaga*; *Trichogramma australicum* Girault attacks *Diatraea* and other injurious insects; *Trichogrammatoidea nana* Zelnit. attacks *Diatraea* and *Grapholita*. In the list of parasites of the larvae of *Diatraea* and *Chilo*, insects hitherto unknown in Java, are: 1) *Iphiaulax medianus* Cam., *Iphiaulax* sp., *Cremnops parvifasciatus* Cam., *Cremnops* sp., *Mesostenoides* sp., all in British Guiana; 2) *Ophion mauritii*, in the Island of Mauritius; 3) *Cachinidae* spp., in British Guiana and Portorico; 4) *Licoderma 4 dentatum* common in British Guiana; 5) an Elater and *Chauliognathus marginatus*, *Drasterius elegans* in Louisiana.

Of importance are *Telenomus* sp. and *Heptasmyra curvilineata* Cam. enemies, the first of the larvae, the second of the pupae, of *Diatraea* in British Guiana.

In conclusion, detailed particulars are given of the experiments made for the purpose of spreading and breeding *Trichogramma* and *Phaenocarpa*, which are without doubt, the most efficacious parasites for the control of the borers of the sugar-cane.

- 596 - **The Effect of Cyanide on the Locust-borer (*Cyflene robiniae*) injurious to the Locust-tree (1).** - FLINT WESLEY P. in *Science*, New series, Vol. XLII, N. pp. 726-727. Lancaster, Pa., 1915.

The researches of F. SANFORD and C. H. SHATTUCK have made it seem probable that at least a part of the borers in infested locust-trees might be killed by introducing small amounts of potassium cyanide in the trunk and bark.

The experiments conducted during 1915, in Illinois by the writer with potassium cyanide and sodium cyanide gave completely negative results.

The larvae were unhurt and continued to bore and excavate the wood within six inches of the auger holes. The cyanide had a very injurious effect on the trees, the bark was dead and the wood discolored for a large distance around the holes where it had been placed.

- 597 - **The Spring Grain Aphis or "Green Bug" (*Toxoptera graminum*) in America.** - WEBSTER E. M. in *United States Department of Agriculture, Office of the Secretary*. Circular No. 55, pp. 1-3, Figs. 1-4. Washington, D. C., February 5, 1916.

The spring grain aphis (*Toxoptera graminum*) popularly known as the green bug, has appeared in grain fields in Tennessee, Texas, Oklahoma, Kansas, and north-eastern New Mexico. It is probable that the green bug has also in southern Missouri and Arkansas, as it is spreading much further north than usual.

These recent outbreaks have been noted as originating largely in fields of early sown wheat, or in wheat fields following oats, which are attacked by preference and may spring up among the corn, thus attracting the aphids, which in consequence spread to the wheat crop.

The principal natural enemy of *Toxoptera* is *Aphidius testaceipes* which lays its eggs in the body of the green bug, and the young, hatching from the eggs within the body of the host, ultimately cause the death of the "bug".

As a means of control the fields should be carefully watched, and the spots where the grain changes from green to yellow should be ploughed under as deeply as possible and the ground harrowed and rolled. Straw may also be spread over the infested patches and burned.

- 598 - **Thrips (*Bagnallia oryzae*), n. sp., Injurious to Rice in India.** - WHITING B. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 353-355, Fig. 1, 1916. February 1916.

Thrips (Bagnallia) oryzae is reported from Madras and described as a new species injurious to rice.

(1) See *E. Oct.* 1915 No. 1103.

80 - *Philephedra theobromae* a new Coccid Pest of Cacao from Trinidad. -

GREEN, ERNEST E. in *Bulletin of Entomological Research*, Vol. VI, Part 1, pp. 177-181, Figs. 1-3. London, February 1-16.

Report on and description of a new coccid *Philephedra theobromae*, and on pods of *Theobroma cacao*; "the insects were enclosed in a cotton bag and attended by the ant, *Azteca costaricensis*", their natural enemy.

81 - *Agriolimax agrestis*, a Gasteropod causing Injury in Market-Gardens in the State of New-York. -

BAKER COLLINS, FRANK M. *Science*, New Series, Vol. XLIII, No. 1100, p. 130. Lancaster, Pa., Jan. 28, 1915.

During the summer of 1915, *Agriolimax agrestis* L., caused considerable damage in market-gardens in various localities in New-York State, attacking the subterranean as well as aerial portions of the plants. At Canandaigua and Rochester it damaged potatoes by hollowing out large galleries in the tubers; at Syracuse, it was found attacking cauliflowers and stuck together with *A. campestris* (Binney).

82 - Animal Pests of Fruit Trees in New South Wales. -

THROUGHTON, W. W. and GURNEY, W. B. in *Department of Agriculture, New South Wales, Forests Bulletin*, No. 2, pp. 1-117, with Figures. Sydney, 1905.

A catalogue of the animal pests most injurious to fruit trees in New South Wales, with illustrative notes on their life history, distribution and the amount of damage they cause.

"Codling Moth" (*Carpocapsa pomonella* Linn.). The adult insects appear towards the beginning of October at blossoming time, copulate and lay their eggs on the apple flowers; the larvae hatched from these eggs penetrate the fruit as it forms, destroying the seeds and spoiling the pulp. About half the apple harvest is ruined every year in this way. For controlling this insect, such good results have been obtained in these last years with arsenate of lead, that the Government has made a law for rendering obligatory the use of that insecticide in the appropriate seasons. The first application should be given within five days of the shedding of the petals, and the others successively in the fourth, sixth, ninth and tenth week after the flowering is ended. "Woolly Aphis" or "American Blight" (*Schizoneura lanigera* Hansm.) appears on apple trees in the summer and spreads rapidly when the leaves fall and the first winter rains begin. The insect cannot resist hot or strong winds, and frequently in the West many dead insects are found lying at the foot of the trees after a period of hot winds. The mild climate of New South Wales is favorable throughout the whole year for the development of this aphid, whose natural foes, including *Leis conformis*, do not constitute a sufficient check to its spread. The best control for *Schizoneura lanigera* is, besides the use of the usual insecticides, the introduction of resistant types, upon which other varieties might also be grafted. "Northern Spy", brought over from America, has shown itself completely immune, and the "Majetin" variety has also proved very satisfactory.

During the spring and early summer of 1913-14, a parasite apparently identifiable as *Thrips tabaci* appeared in large numbers on apple, pear,

and other fruit trees in blossom. The damage caused was most serious: the fruit did not form and the harvest was reduced by 75 per cent. The least injured were the early varieties. The virulence and extent of the attack may be explained by the climatic conditions which were unusually favourable: a mild winter and a warm dry summer up to October. As means of control the application of tobacco extract and soap is advised: good results were also obtained with benzol, which has the advantage of killing the insects and at the same time not injuring even the tenderest shoots.

"San Jose Scale" (*Aspidiotus perniciosus* Comst.) on apple, pear, cherry, plum, peach, apricot, almond etc.

"Mussel Scale" (*Mytilaspis pomorum* Bouché) on apple and pear

"Apple Root Borer" (*Leptops hopei* Schon.) on apple, vine and other fruit trees.

"Pear and Cherry Slug" (*Selandria cerasi*), on pear and cherry.

"Brown Apple Moth" *Cacoecia responsina* (*postvittana*) Walk. — Is common on apple in South Australia, in Victoria and in New South Wales.

"Shot hole Borer" (*Xyleborus solidus* Rich.). Injurious to apple, pear, and plum. As means of control: cut away and burn all infected parts; manure abundantly to stimulate growth and strengthen the plants so as to resist attack; apply a solution of carbolic acid and soap.

Bryobia pratenis Garman. — Attacks and injures apple and pear. Damp weather is unfavourable to this insect, dry weather favours its growth and spreading. As control it is advisable to use sulphide of calcium, applying it at the end of the winter and in early spring so as to kill the eggs and newly hatched larvae.

"Pear-leaf Blister Mite" (*Eriophyes* (*Phytoptus*) *pyri* Pgst.). — On apple and pear. As control, apply kerosene emulsion or sulphide of calcium after the leaves have fallen in early winter, repeating the operation if necessary at the end of the spring before budding time.

"Pear and Cherry Tree Borer" (*Cryptophaga* spp.). — Are injurious to pear and cherry; it is easily controlled with kerosene.

"Fruit Fly" (*Ceratitis capitata* Wiedm.) Generally on peach, orange and less frequently on pear and apple (in New England). Means of control: 1) gathering the infected fruit either for destruction or for boiling so as to prevent the emergence of the larvae;

2) dig deeply and frequently into the ground, turning it up so as to expose the pupæ hidden in the soil.

"Pointed Acacia Moth" (*Teia anartoides* Walk.). — Damages the foliage of cherry, apple, rose, pelargoniums and other orchard and garden plants.

"Emperor Gum Moth" (*Antheraea eucalypti* Scott.). — Feeds on *Eucalyptus* leaves but is occasionally found on apple.

"Grey-streaked Climbing Cutworm" (*Prodenia littoralis* Bois-d.). Occasionally attacks apple and may be controlled effectually with applications of arsenate of lead.

***Recurvaria nanella*, Micro-lepidopteron Injurious to Fruit Trees in Italy.**

MIGNONE A. in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze Fisiche, Matematiche e Naturali*, Vol. XXV, Part. 1 (1914-15), pp. 188-191, Roma, 1915.

In the first fortnight of March 1915 small red-brown larvae were found in the orchards and gardens of Rome that injured the flowers of apple trees. They were recognised as the larvae of a micro-lepidopteron and identified as *Recurvaria nanella* Hb. Nearly all fruit trees of the family Rosaceae are the host-plants.

The moths are very small and begin to appear after the middle of June or are most numerous in the first half of July. They remain during the day almost motionless with closed wings in the fork-fissures of the trunk of larger branches. The young larvae appear towards the end of August in the Roman orchards and gardens; they feed principally on the leaves of apple and apricot; to a lesser degree they may be found also on cherry, yellow cherry, apple, quince and pear. The almond tree and Hawthorn are entirely immune. The young larvae penetrate into the leaf by a tiny circular puncture in the under-surface, preferably near a vein or in the gaps formed by the veins. When inside the leaf they excavate short and reel-like galleries which are usually straight at first and then become sinuous, branching into different directions. The small caterpillars feed on the green parenchyma of the leaf leaving the epidermis intact, but as the veins to wither at the places closed by their galleries. When the bud season arrives they retire into the cracks and crevices of the bark where they hibernate in a small cocoon. The young larvae overwinter on these winter coverings at the time when the host-trees begin to blossom and, in search of food, climb up to the flower buds where they make their round, slightly oval puncture at the insertion of the peduncle. A puncture penetrates through the various coverings to the centre of a bud, i. e., to the gynaecium, where the pistil is attached to the axis, or to the receptacle. Besides the flower buds, the larvae attack also the leaf-buds of the tender unopened shoots. Entering the young sprouts they spin thick threads round the tiny leaves binding them strongly together and ordering their normal growth and development. The shoots become deformed and this deformation becomes more marked as the leaves tend to unfurl. In addition the larvae nibble the leaves more or less extensively and do not even spare the veins.

The caterpillars remain on the green parts of the plants until about the end of April, and afterwards migrate to the woody parts to hide in the bark when, finding a convenient place, they spin a tiny white cocoon and pupate.

***Plesiocoris rugicollis* and *Orthotylus marginalis*, Capsids Injurious to Apple Trees and Fruit in England.** DRYDEN, C. L. in *The Entomologist's Monthly Review*, Vol. XXII, No. 10, pp. 365-375, Fig. 101, London, January 1917.

Plesiocoris rugicollis and *Orthotylus marginalis*, two hemiptera of the family *Capsidae*, are extremely injurious to apple trees and fruit in England

After these insects have punctured the tissues of the plant in order to suck up its juices, the portions of the plant surrounding the puncture appear as if poisoned and either die or undergo an abnormal development. The leaves at first show scattered red or brown spots which later die and frequently drop out, leaving an undersized and ragged leaf which is incapable of doing its share in supporting the plant. The terminal-shoot and the branch suffers most severely, and there is, in consequence, an excessive production of short lateral twigs which often give a characteristic appearance to attacked-trees. The fruit in mild cases becomes distorted, some parts failing to develop, others growing abnormally so that there are scattered pits and pimples over the surface. The skin shows rough discolored areas sharply divided from the normal parts. The flesh underneath becomes shrivelled rendering most of the fruit unsaleable.

Not all varieties suffer in the same degree: Bramley's Seedling and Early Victoria ("Emmett Early") do so but slightly. Allington, Pige Beauty of Bath, Gladstone, Grenadier, King of the Pippins, Lady Prince Albert, Lord Derby, Lord Grosvenor, and Worcester Pearmain are usually seriously injured.

Both *Plesiocoris ragicollis* and *Orthotylus marginalis* are natives of the British Isles and are widely distributed in almost every County but mostly in the Counties of Cambridge, Suffolk, Kent, Sussex, Worcester, Hereford, Devon, and Cornwall. Formerly they were said to feed on willow and sallow, and to a lesser degree on alder and hazel. Apple as a host-plant seems to have been only recently added to the series of host-plants. Spraying with nicotine and soap is advised as a satisfactory means of control.

601 **Banana (*Musa* spp.) as a Host Fruit of the Mediterranean Fruit Fly (*Ceratitis capitata*) in the Hawaiian Islands** (1).—BACK E. A. and LEMBERT C. L. *Journal of Agricultural Research*, Vol. V, No. 17, pp. 793-804, PL. I, II, LXXII. Washington, D. C., January 23, 1916.

The banana export trade of the Hawaiian Islands having lately become very important, it has therefore become imperative to take any necessary precautions for the protection of mainland fruit interests against any possible infection.

The Mediterranean fruit fly, (*Ceratitis capitata* Wied.) attacks the bananas and lays its eggs in the peel, from whence the larvae on emerging penetrate to the pulp and cause it to rot.

The unripe green fruit is not attacked. The peel when green is so much charged with sap laden with tannic acid that the slightest scratch produces a flow of this fluid which kills the eggs, or hinders the female from depositing them.

The thin-skinned Poponiu and Moa varieties (*Musa* spp.) are most frequently attacked by the insect, while the Chinese banana (*Musa Cavendishii*) and the Bluefield banana (*Musa* sp.) are almost completely immune to attack.

(1) See, *B.* April 1-16, No. 484.

Not 1 out of 1,044 fruits of the Chinese banana ripening singly and peculiarly in most favourable conditions for the purpose of oviposition, was found to be infested. From the facts stated, the writers believe that gages of Chinese banana and Bluefield banana, when properly inspected for the removal of prematurely ripe, cracked or partially decayed fruits, are no danger as carriers of *Ceratitis*, provided they are wrapped and shipped in accordance with the demands of the trade and the Federal regulations.

Observations on the Life Histories of some Insects Injurious to Pine Trees, in the State Forests of the Province of Minsk (Russia). L. GORUMASKI, *Trudy Gos. Lesn. Zapovedn. (The Forestry Review)*, Vol. XIV, 1918, pp. 1-14. (Petrograd, 1918.)

These observations were made in the pine woods of Mukhon-Jowsk; the following insects injurious to pine trees: 1) *Melospiles minor* (Hart.); 2) *M. piniperda* L.; 3) *Ips sexdentatus* Förm.

The most detailed observations were made of *M. minor*.

Having elucidated the most obscure points of the life history of this insect, the writer says that its development comprises the following eight phases: 1) egg; 2) larva under the bark; 3) larva in the nest; 4) pupa; 5) young insect in the nest; 6) adult, injurious to the young pine shoots; 7) hibernating insect; 8) egg-laying insect.

As it is most difficult if not quite impossible to control *M. minor* in phases, 3, 4, 5, 6 and 7, it only remains feasible to do so during phases 1, 2 and 8, during which *M. minor* is concealed under the bark of the attacked pine trees. The writer says that all works on the subject advise the destruction of the insect when in the larval stage, while the egg-laying insect receives no attention; on the other hand, the study of its life-history shows that special attention should be paid precisely to the last stage.

With regard to this phase of the insect's life, the writer points out that:

1) *M. minor*, during its life cycle injures the pine trees twice, the first time on emerging from the cocoon in the year of its birth, the second after laying its eggs in the year following; 2) in controlling the insect it is necessary to destroy not only the future but the present generations, the barking of the attacked trees should therefore be done at the time when the adults lay their eggs.

Lastly, the writer reports an observation that may be useful in controlling the insect: in the parts of the felled trees exposed to the action of the sun no adults were found in the galleries, while in parts always in the shade they were found in considerable numbers. From this fact, which, in the writer's opinion, should be better investigated, it might be concluded that to destroy *M. minor*, which attacks the lower side of the felled trees lying on the ground, it would suffice to turn the trees in such a way as to expose the greater part of the insect's galleries towards the sun. If this conclusion is confirmed by further observations, this practice may prove very useful in case of a great diffusion of the insect, for example after a great storm, when the barking of the trees might be difficult to carry out on the many but fall.

666 - *Ripersia resinophila*, a Coccid Injurious to Pine Trees in the Himalayas.

GREEN, E. E. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 395-400, 1916.
Pl. XVII, London, February 1916.

A new species reported and described. *Ripersia resinophila* was found on *Pinus longifolia*, at Kumaon in the Himalayas; and on *Pinus* sp. in the division of Kamaraj, Kashmir. It attacks young plants. The Coccids on hatching, at first crawl up the twigs and ensconce themselves between the pine needles in which they feed. Badly affected trees are very little in height, only in thickness. The pest is not absolutely confined to young plants, but is found also, though less frequently, on branches of large trees. It is much attacked by Coccinellidae and parasitic Hymenoptera, while ants swarm on badly affected trees.

The writer's attention was first called to the insect by Mr. C. M. McCann, who found it in abundance at Takula, Binsar, Bhowali and Rangahat (all in Kumaon). It appears commonest on hot sunny hill-sides, at elevations between 4,000 and 5,800 feet.

667 - Report on Insects Injurious to Flour and Grain in the Province of Ekaterinoslav (South Russia) in 1915. - WYKOWSKIJ N. in *Khodostan*, Year XI, No. 1, pp. 51-59, Kiev, 1916.

The report presented by the author to the Conference of November 21, 1915, on protecting flour and grain from the attacks of *Calandra granaria* L. and other harmful insects, contains: the description of these insects found in the province of Ekaterinoslav; observations made regarding their life history, and the methods of control used by the Ekaterinoslav organisation for the provisioning of the army.

The accumulation of large quantities of grain and flour in railway and private warehouses greatly contributed to spread of insects harmful to those products.

During the spring and summer of 1915 the writer found the following species: 1) *C. granaria* L.; 2) *Tribolium confusum* Duv.; 3) *Tenebrio molitor* L.; 4) *Sitona surinamensis* L.; 5) *Leucophloeus testaceus* L.; 6) *Leucobroides matritonicus* L.; 7) *Ephesia kühniella* Zell.; 8) *Plodia interpunctella* Hb.; 9) *Asopia (Pyrallis) farinalis* L.

C. granaria was found among wheat (the most damaged) and also among rye and oats.

Large quantities were found in one of the railway warehouses visited. The researches carried out on some thousands of grains have shown the percentage of damage to be from 8 to 10 % and the loss in weight 0.5 %.

The following observations were made:

1) When the grain is stored in sacks, the multiplication of the insect is hindered by the adults not being all able to escape from the sacks, further the fertilised females do not all succeed in penetrating into the sacks to lay their eggs; 2) when the grain is stored in the warehouses in heaps the activity of the insect finds an obstacle in the depth of the layers of grain; this has been proved by the fact that the insects have been found only in the upper parts. The writer gives an example of this in the case of a grain heap, which had been stored for 12 years, where *C. granaria* only in any

quantity about 0.6 to 0.7 m. deep, was found in the upper stratum while in the lower strata the grain was perfectly sound.

For preventing the damage, caused by *E. granaria* the writer advises the refusal of grain infested by the insect and containing more than 1 1/2 per cent of moisture, the excess of moisture being most favourable to the insect's development. According to the researches of STRAKHOW KOLOCHNE, entomologist of the province of Voronezh, *E. granaria* not only does not multiply in grain containing a small degree of moisture, but even those individuals that succeed in reaching it die out rapidly.

With regard to *Ephestia Kühniella*, the writer states that it has spread enormously and is a dangerous pest of wheat flour. Though the writer's researches are still incomplete yet they prove that not all flour is infested by the insect, and what was attacked originated from a certain number of mills where *E. Kühniella* was abundant. It has also been proved that the larvae emerging from the eggs deposited by the females on the outside of the sacks, penetrate the sacks themselves and form nests in the flour by connecting together the larger particles with silken threads. When, however, the time of transformation from larva to chrysalis approaches, the larvae try to escape from the sack. *E. Kühniella* like *E. granaria*, needs freedom for successful fertilisation and oviposition. The larvae work themselves out of the sack with their mandibles passing between the threads without injuring the cloth. The larvae do not all succeed in escaping from the sack and the moths die unfertilized in the flour. The transformation into chrysalids lasts from one to two weeks. Great numbers of *E. Kühniella* moths were observed from the middle of July to the middle of August.

It is interesting to note that during the months of August and September a great mortality was observed among the larvae of the insect, caused by a small endoparasite as yet not identified. The writer has been able to observe some cases of this endoparasite laying its eggs in the bodies of the larvae of *E. Kühniella*. The larvae which covered the flour-sacks lying at the Ekaterinoslav station were all dead, and the writer obtained from them a parasite belonging to the same species he had observed in the warehouses laying its eggs in the larvae of *E. Kühniella*.

As a means of defence the writer advises sifting the flour as soon as the cold season begins, and its immediate removal from the mills. As the larvae of *E. Kühniella* live in nests it is most probable that the sifting would remove the larvae, together with their nests and larval refuse. The system of sifting the flour was applied at a mill in the province of Ekaterinoslav and has given very good results both from an hygienic and an economic point of view. The operation costs about 4d to 5d per 220 lbs. of flour.

